

Handbook of Research on

Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management

Kaabouch & Hu

Handbook of Research on Software-Defined and
Cognitive Radio Technologies for
Dynamic Spectrum Management

Volume I



Naïma Kaabouch and Wen-Chen Hu



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Handbook Of Research On Software Defined And Cognitive Radio Technologies For Dynamic Spectrum Management Advances In Wireless Technologies And Telecommunication

Bruce A. Fette



Handbook Of Research On Software Defined And Cognitive Radio Technologies For Dynamic Spectrum Management Advances In Wireless Technologies And Telecommunication:

Handbook of Research on Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management Kaabouch, Naima, Hu, Wen-Chen, 2014-10-31 The inadequate use of wireless spectrum resources has recently motivated researchers and practitioners to look for new ways to improve resource efficiency As a result new cognitive radio technologies have been proposed as an effective solution The Handbook of Research on Software Defined and Cognitive Radio Technologies for Dynamic Spectrum Management examines the emerging technologies being used to overcome radio spectrum scarcity Providing timely and comprehensive coverage on topics pertaining to channel estimation spectrum sensing communication security frequency hopping and smart antennas this research work is essential for use by educators industrialists and graduate students as well as academicians researching in the field Handbook of Research on Software-defined and Cognitive Radio Technologies for Dynamic Spectrum Management Naima Kaabouch, Wen Chen Hu, 2015 This book examines the emerging technologies being used to overcome radio spectrum scarcity providing timely and comprehensive coverage on topics pertaining to channel estimation spectrum sensing communication security frequency hopping and smart antennas Handbook of Research on Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management, Vol 2 Naima Kaabouch, 2015-02-02 *Handbook of Research on Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management, Vol 1* Naima Kaabouch, 2015-02-02 *Cognitive Networks* Qusay Mahmoud, 2007-08-20 Cognitive networks can dynamically adapt their operational parameters in response to user needs or changing environmental conditions They can learn from these adaptations and exploit knowledge to make future decisions Cognitive networks are the future and they are needed simply because they enable users to focus on things other than configuring and managing networks Without cognitive networks the pervasive computing vision calls for every consumer to be a network technician The applications of cognitive networks enable the vision of pervasive computing seamless mobility ad hoc networks and dynamic spectrum allocation among others In detail the authors describe the main features of cognitive networks clearly indicating that cognitive network design can be applied to any type of network being fixed or wireless They explain why cognitive networks promise better protection against security attacks and network intruders and how such networks will benefit the service operator as well as the consumer Cognitive Networks Explores the state of the art in cognitive networks compiling a roadmap to future research Covers the topic of cognitive radio including semantic aspects Presents hot topics such as biologically inspired networking autonomic networking and adaptive networking Introduces the applications of machine learning and distributed reasoning to cognitive networks Addresses cross layer design and optimization Discusses security and intrusion detection in cognitive networks Cognitive Networks is essential reading for advanced students researchers as well as practitioners interested in cognitive wireless networks pervasive computing

distributed learning seamless mobility and self governed networks With forewords by Joseph Mitola III as well as Sudhir Dixit

Spectrum and Power Allocation in Cognitive Radio Systems Suriyan, Kannadhasan,R., Dhaya,Nagarajan, R.,Karthick, Alagar,2024-08-06 As wireless services rapidly expand the inefficient use of limited spectrum resources poses a critical challenge The conventional approach to spectrum allocation based on fixed assignments could be more effective in meeting the escalating demand for wireless devices and systems Cognitive radio technology offers a transformative solution by reimagining the spectrum as a multidimensional space enabling opportunistic access to underutilized bands However the field of cognitive radio is still in its early stages needing more in depth analyses and descriptions of crucial processes

Spectrum and Power Allocation in Cognitive Radio Systems addresses this pressing need by offering a comprehensive guide for academic scholars researchers and industry professionals This book delves into cognitive radio technology s foundations organization and challenges providing insights into dynamic spectrum access networking protocols hardware architecture and emerging applications It presents advanced topics such as spectrum sensing algorithms cooperative spectrum sensing and multi user access offering practical solutions to enhance spectrum efficiency

Cognitive Radio Technology Applications for Wireless and Mobile Ad Hoc Networks Meghanathan, Natarajan,Reddy, Yenumula B.,2013-06-30 Radio interference is a problem that has plagued air communication since its inception Advances in cognitive radio science help to mitigate these concerns Cognitive Radio Technology Applications for Wireless and Mobile Ad Hoc Networks provides an in depth exploration of cognitive radio and its applications in mobile and or wireless network settings The book combines a discussion of existing literature with current and future research to create an integrated approach that is useful both as a textbook for students of computer science and as a reference book for researchers and practitioners engaged in solving the complex problems and future challenges of cognitive radio technologies

Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems Hüseyin Arslan,2007-08-17 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 This book discusses the cognitive radio software defined radio and adaptive radio concepts from several perspectives

Cognitive Radio Policy and Regulation Arturas Medeisis,Oliver Holland,2014-02-12 This book offers a timely reflection on how the proliferation of advanced wireless communications technologies particularly cognitive radio CR can be enabled by thoroughly considered policy and appropriate regulation It looks at the prospects of CR from the divergent standpoints of technological development and economic market reality The book provides a broad survey of various techno economic and policy aspects of CR development and provides the reader with an understanding of the complexities involved as well as a toolbox of possible solutions to enable the evolutionary leap towards successful implementation of disruptive CR technology or indeed any other novel

wireless technologies Cognitive Radio Policy and Regulation showcases the original ideas and concepts introduced into the field of CR and dynamic spectrum access policy over nearly four years of work within COST Action IC0905 TERRA a think tank with participants from more than 20 countries The book s subject matter includes deployment scenarios for CR technical approaches for improved spectrum sharing economic aspects of CR policy and regulation impact assessment of cognitive and software defined radio and novel approaches to spectrum policy and regulation for the age of CR The book will interest researchers in the field of wireless communications especially those working with standardization and policy issues as well as industry and regulatory professionals concerned with radio spectrum management and the general development of wireless communications Considerable complementary reference material such as power point slides and technical reports that illustrates and expands on the contents of the book is provided on the companion website to the book found at <http://www.cost-terra.org/CR-policy-book>

Spectrum Access and Management for Cognitive Radio Networks Mohammad A Matin, 2016-09-16 This book presents cutting edge research contributions that address various aspects of network design optimization implementation and application of cognitive radio technologies It demonstrates how to make better utilization of the available spectrum cognitive radios and spectrum access to achieve effective spectrum sharing between licensed and unlicensed users The book provides academics and researchers essential information on current developments and future trends in cognitive radios for possible integration with the upcoming 5G networks In addition it includes a brief introduction to cognitive radio networks for newcomers to the field

Radio Resource Allocation and Dynamic Spectrum Access Badr Benmammar, Asma Amraoui, 2013-02-05 We are currently witnessing an increase in telecommunications norms and standards given the recent advances in this field The increasing number of normalized standards paves the way for an increase in the range of services available for each consumer Moreover the majority of available radio frequencies have already been allocated This explains the emergence of cognitive radio CR the sharing of the spectrum between a primary user and a secondary user In this book we will present the state of the art of the different techniques for spectrum access using cooperation and competition to solve the problem of spectrum allocation and ensure better management of radio resources in a radio cognitive context The different aspects of research explored up until now on the applications of multi agent systems MAS in the field of cognitive radio are analyzed in this book The first chapter begins with an insight into wireless networks and mobiles with special focus 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 at the boundary between telecommunications and Artificial Intelligence AI In Chapter 3 the concept of the agent from AI is expanded to MAS and associated applications Finally Chapter 4 establishes an overview of the use of AI techniques in particular MAS for its allocation of radio resources and dynamic access to the 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 University Abou Bekr Belkaid Tlemcen

Algeria since 2010 and was a research fellow at CNRS LaBRI Laboratory of the University of Bordeaux 1 until 2007 He is currently carrying out research at the Laboratory 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 end signaling protocols and agent technology His work on Quality of Service has led to many publications in journals and conference proceedings Asma Amraoui is currently a PhD candidate she is preparing a doctoral thesis on a topic of research that explores the use of artificial intelligence techniques in cognitive radio networks She is attached to the Laboratory of Telecommunications of Tlemcen LTT in Algeria

Cognitive Radio, Mobile Communications and Wireless Networks

Mubashir Husain Rehmani,Riadh Dhaou,2018-07-30 This book provides an overview of the latest research and development of new technologies for cognitive radio mobile communications and wireless networks The contributors discuss the research and requirement analysis and initial standardization work towards 5G cellular systems and the capacity problems it presents They show how cognitive radio with the capability to flexibly adapt its parameters has been proposed as the enabling technology for unlicensed secondary users to dynamically access the licensed spectrum owned by legacy primary users on a negotiated or an opportunistic basis They go on to show how cognitive radio is now perceived in a much broader paradigm that will contribute to solve the resource allocation problem that 5G requirements raise The chapters represent hand selected expanded papers from EAI sponsored and hosted conferences such as the 12th EAI International Conference on Mobile and Ubiquitous Systems the 11th EAI International Conference on Heterogeneous Networking for Quality Reliability Security and Robustness the 10th International Conference on Cognitive Radio Oriented Wireless Networks the 8th International Conference on Mobile Multimedia Communications and the EAI International Conference on Software Defined Wireless Networks and Cognitive Technologies for IoT

Cognitive Radio and Dynamic Spectrum Access

Lars Berlemann,Stefan Mangold,2009-07-10 Cognitive Radio for Dynamic Spectrum Access gives a comprehensive overview of the main concepts behind radio spectrum regulation dynamic spectrum access and cognitive radio Spectrum measurements are introduced to illustrate the inefficiencies in today s spectrum usage and the book also discusses enablers for horizontal and vertical spectrum sharing Among others a game theory based approach for spectrum sharing is described and evaluated Institution and standardisation approaches in academic research and industry are highlighted including IEEE SCC41 802 11k n s y and 802 22 which lead towards commercial exploitation of cognitive radio In conclusion this book looks at the initial steps towards the vision of true cognitive radio and the potential impact on telecommunication business Introduces the benefits and challenges of cognitive radio Presents cognitive radio in research and industry and covers implications for operators from the perspective of a telecom operator Examines how cognitive radio techniques will considerably change the wireless communication market

Cognitive Radio Technology Bruce A. Fette,2009-04-28 This book gives a thorough knowledge of cognitive radio concepts principles standards spectrum policy issues and product implementation details In

addition to 16 chapters covering all the basics of cognitive radio this new edition has eight brand new chapters covering cognitive radio in multiple antenna systems policy language and policy engine spectrum sensing rendezvous techniques spectrum consumption models protocols for adaptation cognitive networking and information on the latest standards making it an indispensable resource for the RF and wireless engineer The new edition of this cutting edge reference which gives a thorough knowledge of principles implementation details standards policy issues in one volume enables the RF and wireless engineer to master and apply today's cognitive radio technologies Bruce Fette PhD is Chief Scientist in the Communications Networking Division of General Dynamics C4 Systems in Scottsdale AZ He worked with the Software Defined Radio SDR Forum from its inception currently performing the role of Technical Chair and is a panelist for the IEEE Conference on Acoustics Speech and Signal Processing Industrial Technology Track He currently heads the General Dynamics Signal Processing Center of Excellence in the Communication Networks Division Dr Fette has 36 patents and has been awarded the Distinguished Innovator Award Foreword and a chapter contribution by Joe Mitola the creator of the field Discussion of cognitive aids to the user spectrum owner network operator Explanation of capabilities such as time position awareness speech and language awareness multi objective radio and network optimization and supporting database infrastructure Detailed information on product implementation to aid product developers Thorough descriptions of each cognitive radio component technology provided by leaders of their respective fields and the latest in high performance analysis implementation techniques Explanations of the complex architecture and terminology of the current standards activities Discussions of market opportunities created by cognitive radio technology *Dynamic Spectrum Management* Ying-Chang Liang, 2019-11-02 This open access book authored by a world leading researcher in this field describes fundamentals of dynamic spectrum management provides a systematic overview on the enabling technologies covering cognitive radio blockchain and artificial intelligence and offers valuable guidance for designing advanced wireless communications systems This book is intended for a broad range of readers including students and professionals in this field as well as radio spectrum policy makers Software Defined Radios Sofie Pollin, Michael Timmers, Liesbet Van der Perre, 2011-04-27 Many and ever more mobile users wish to enjoy a variety of multimedia services in very diverse geographical environments The growing number of communication options within and across wireless standards is accommodating the growing volume and heterogeneity in wireless wishes On the other hand advancement in radio technologies opening much more flexibility a o through Software Defined Radios opens up the possibility to realize mobile devices featuring multi mode options at low cost and interesting form factors It is crucial to manage the new degrees of freedom opened up in radios and standards in a smart way such that the required service is offered at satisfactory quality as efficiently as possible Efficiency in energy consumption is clearly primordial for battery powered mobile terminals specifically and in the context of growing ecological concerns in a broader context Moreover efficient usage of the spectrum is a growing prerequisite for wireless systems and coexistence of

different standards puts overall throughput at risk The management of flexibility risks bringing about intolerable complexity and hamper the desired agility A systematic approach consisting of anticipative preparing for smooth operation allows mastering this challenge Case studies show that already today this approach enables smart operation of radios realizing impressive efficiency gains without hampering Quality of Service In the future wireless communication scenes will be able to profit from the opening of the spectrum Even smarter and cognitive behavior will become possible and essential

Cognitive Radio in 4G/5G Wireless Communication Systems Shahriar Shirvani Moghaddam, 2018-12-05 The limitation of the radio spectrum and the rapid growth of communication applications make optimal usage of radio resources essential Cognitive radio CR is an attractive research area for 4G 5G wireless communication systems which enables unlicensed users to access the spectrum Delivering higher spectral efficiency supporting the higher number of users and achieving higher coverage and throughput are the main advantages of CR based networks compared to conventional ones The main goal of this book is to provide highlights of current research topics in the field of CR based systems The book consists of six chapters in three sections focusing on primary and secondary users spectrum sensing spectrum sharing CR based IoT emulation attack and interference alignment

Sensing Techniques for Next Generation Cognitive Radio Networks Bagwari, Ashish, Bagwari, Jyotshana, Tomar, Geetam Singh, 2018-08-30 The inadequate use of wireless spectrum resources has recently motivated researchers and practitioners to look for new ways to improve resource efficiency As a result new cognitive radio technologies have been proposed as an effective solution Sensing Techniques for Next Generation Cognitive Radio Networks is a pivotal reference source that provides vital research on the application of spectrum sensing techniques While highlighting topics such as radio identification compressive sensing and wavelet transform this publication explores the standards and the methods of cognitive radio network architecture This book is ideally designed for IT and network engineers practitioners and researchers seeking current research on radio scene analysis for cognitive radios and networks

Software Defined Radio Markus Dillinger, Kambiz Madani, Nancy Alonistioti, 2005-08-05 Software defined radio SDR is a hot topic in the telecommunications field with regard to wireless technology It is one of the most important topics of research in the area of mobile and personal communications SDR is viewed as the enabler of global roaming and a platform for the introduction of new technologies and services into existing live networks It therefore gives networks a greater flexibility into mobile communications It bridges the inter disciplinary gap in the field as SDR covers two areas of development namely software development and digital signal processing and the internet It extends well beyond the simple re configuration of air interface parameters to cover the whole system from the network to service creation and application development Reconfigurability entails the pervasive use of software reconfiguration empowering upgrades or patching of any element of the network and of the services and applications running on it It cuts across the types of bearer radio systems Paging to cellular wireless local area network to microwave terrestrial to satellite personal communications to broadcasting

enable the integration of many of today's disparate systems in the same hardware platform. Also, it cuts across generation second to third to fourth. This volume complements the already published volumes 1 and 2 of the Wiley Series in Software Radio. The book discusses the requirements for reconfigurability and then introduces network architectures and functions for reconfigurable terminals. Finally, it deals with reconfiguration in the network. The book also provides a comprehensive view on reconfigurability in three very active research projects as CAST, MOBIVAS, and TRUST SCOUT. Key features include: Presents new research in wireless communications; Summarises the results of an extensive research program on software defined radios in Europe; Provides a comprehensive view on reconfigurability in three very active research projects as CAST, Configurable radio with Advanced Software Technology, MOBIVAS, Downloadable MOBILE Value Added Services through Software Radio and Switching Integrated Platforms, TRUST, Transparently Reconfigurable Ubiquitous Terminal, and SCOUT, Smart User Centric Communication Environment.

Software Defined Radio Walter H.W. Tuttlebee, 2002-06-24

Software defined radio (SDR) is one of the most important topics of research and indeed development in the area of mobile and personal communications. SDR is viewed as an enabler of global roaming and as a unique platform for the rapid introduction of new services into existing live networks. It therefore promises mobile communication networks a major increase in flexibility and capability. SDR brings together two key technologies of the last decade: digital radio and downloadable software. It encompasses not only reconfiguration of the air interface parameters of handset and base station products but also the whole mobile network to facilitate the dynamic introduction of new functionality and mass customised applications to the user's terminal post purchase. This edited book, contributed by internationally respected researchers and industry practitioners, describes the current technological status of radio frequency design, data conversion, reconfigurable signal processing, hardware and software issues at all levels of the protocol stack and network. The book provides a holistic treatment of SDR, addressing the full breadth of relevant technologies: radio frequency design, signal processing, and software at all levels. As such, it provides a solid grounding for a new generation of wireless engineers for whom radio design in future will assume dynamic flexibility as a given. In particular, it explores the unique demands of SDR upon the RF subsystem and their implications for front end design methodologies. The recent concepts of the digital front end and parametrization, the role and key influence of data conversion technologies and devices within software radio, essential to robust product design, the evolution of signal processing technologies, describing new architectural approaches, requirements and options for software download, advances in soft protocols and on the fly software reconfiguration, management of terminal reconfiguration and its network implications, the concepts of the waveform description language. The book also includes coverage of potential breakthrough technologies such as superconducting RSFQ technology and the possible future role of MEMS in RF circuitry. Competing approaches, e.g. all software radios implemented on commodity computing vs. advanced processing architectures that dynamically optimise their configuration to match the algorithm requirements at a point in time. The book opens with an

introductory chapter by Stephen Blust Chair of the ITU R WP8F Committee and Chair of the SDR Forum presenting a framework for SDR in terms of definitions evolutionary perspectives introductory timescales and regulation Suitable for today s engineers technical staff and researchers within the wireless industry the book will also appeal to marketing and commercial managers who need to understand the basics and potential of the technology for future product development Its balance of industrial and academic contributors also makes it suitable as a text for graduate and post graduate courses aiming to prepare the next generation of wireless engineers

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