Foreword

Since the formulation of cognitive radio in the late 1990s, there have been a few notable milestones in wireless systems engineering. From my personal perspective one of the most important early milestones was the Dagstuhl workshop in 2004 that accelerated the shift in focus from a cognitive wireless device to cognitive wireless networks. This led to the book *Cooperation in Wireless Networks: Principles and Applications* edited by Frank Fitzek and Marcos Katz, which captured much of the early thinking on this subject. Thomas Lagkas’s book on the evolution of cognitive networks and self-adaptive communications systems is another such significant milestone in the development of this critical enabling technology.

Wireless networks have been rapidly expanded in business and home environments making wireless a huge market. Smart phones, digital tablets like Kindle, and other Personal Digital Assistants (PDAs) are spread across the globe. Mobile phones with what once would have been called supercomputer capabilities are almost everywhere and laptops with wireless connections are selling in great numbers. In addition, the Internet of Things is on the rise where every appliance from refrigerator to oven will have a wireless connection for cooperation to use energy more efficiently, to improve the living experience, and much more.

*The Evolution of Cognitive Networks and Self-Adaptive Communications Systems* brings together important new technical contributions in how to make all of this happen both for growth of the commercial sectors and for the greater good of humankind. The superb chapters provide insights and tools for wireless networks to allow users to stay connected and to be productive anywhere. For example, the chapter by Kritikou develops eLearning as a motivating use case. How’s chapter on mesh protocols develops technology for knitting together a robust and supportive environment from devices in the home or workplace.

Driven by the mobility of society, convenience, and ease of use of wireless products, users would like to go beyond the distinction between services offered from wireless and wireline networks. Chapters by Karestos (relay), Rehmani (broadcast channel selection), Manzalini (Self Organizing Networks [SON] and virtual resources), and Demestichas (fiber optics) develop techniques that are helpful in erasing the distinctions between wireless and wireline. As interactive applications such as IP and video telephony, streaming video, and interactive video games have become very popular, they bring tight constraints to the network performance requirements. Vassaki’s chapter on Radio Resource Management (RRM) for Quality of Service (Qos), and Chatzikokolakis’s chapter on spectrum aggregation show how to enhance the wireless networks to address these and other such challenges. Kondareddy’s chapter on TCP in cognitive radio networks addresses an important challenge in wireless-wireline integration.

Wireless communication poses new challenges in wireless network design. Efficient medium access techniques, transmission errors at the wireless medium, variable bit rate adjusting to wireless medium
conditions, connection to the most suitable base station as the mobile user moves around, energy saving techniques due to limited battery power of mobile devices, best path selection in multi-hop mesh networks and admission control of new stations are some of the critical issues that should be addressed in efficient Network Design. These new and challenging problems of mobile and wireless network design, combined with the tight constraints and QoS required by interactive applications offer fruitful new areas of research. Kliazovich’s chapter on signaling for the cognitive media access control layer, and Bourdena’s chapter on TV white space markets offer important new insights in addressing such challenges.

Policy questions loom large. For example, such convenience at home, work, and play may be both a benefit and a curse without attention to security and privacy, so Dabčević’s chapter on security stands out as a particularly important contribution. Regulatory policy can be an impediment or an enabler as Anker’s chapter addresses. Finally, careful attention to experimentation as developed in Tonelli’s chapter is the foundation of progress.

In short, this book will be a valuable reference to researchers and developers in the fields of wireless network design. In addition, it should help new entrants in this field with its contributions in the most important topics in the field. The book presents the wireless network community with the current research trends for efficient MAC design and QoS in wireless networks to inspire future research in these important areas. The variety of topics and the depth and breadth of treatment should make it a valuable reference to active researchers as well.

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Joseph Mitola III, recognized globally as the father of software radio and cognitive radio, Dr. Mitola is founder and Chief Technology Officer of Mitola’s STATISfaction, where his research interests focus on trustable, teachable cognitive systems including multifunction trustable agile radio frequency (RF) systems, and mathematically secure computing and communications. STATISfaction’s publications have included the first commercial software radio architecture (May 1995 issue of the IEEE Communications Magazine) and the first cognitive radio architecture (Wiley, 2006). STATISfaction focuses on user satisfaction; intellectual property includes analytical models of classes of user, use context, and wireless infrastructure capabilities and limitations as well as high fidelity multi-media digital vignettes for advanced wearable information prosthetics. Previously, Dr. Mitola was Vice President for the Research Enterprise of Stevens Institute of Technology where he led faculty teams in pursuit and execution of a wide range of technologies. He also has served as Chief Scientist of the U.S. Department of Defense (DoD) Federally Funded Research and Development Center for The MITRE Corporation; Joint Special Assistant to the Director of the US Defense Advanced Research Projects Agency (DARPA) and to the Deputy Director of the US National Security Agency (NSA) for trustable cognitive systems; DARPA Program Manager; Technical Advisor to the Executive Office of the President of the United States; and Technical Director of Modeling and Simulation for DoD. He has held positions of technical leadership with E-Systems, Harris Corporation, Advanced Decision Systems, and ITT Corporation. Dr. Mitola began his career as an engineering student assistant with DoD in 1967. His graduate textbooks include Software Radio Architecture (Wiley 2000) and Cognitive Radio Architecture (Wiley, 2006). Dr. Mitola received the B.S. degree in electrical engineering from Northeastern University, Boston, MA, in 1971, the M.S.E. degree from The Johns Hopkins University, Baltimore, MD, in 1974, and the Licentiate (1999) and doctorate degrees in teleinformatics from KTH, The Royal Institute of Technology, Stockholm, Sweden, in 1999 and 2000, respectively.

ENDNOTES

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