

## CURRICULUM VITAE

### **Marwan M. Krunz**

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## Biographical Sketches

**Marwan Krunz** received his Ph.D. in Electrical Engineering from Michigan State University in 1995. He joined the University of Arizona (UA) as an assistant professor in 1997, following a postdoctoral stint at the University of Maryland, College Park. Currently, he is the Kenneth VonBehren Endowed Professor in Electrical & Computer Engineering at the UA, and is also a professor of computer science. He is the co-founder and lead director of the Broadband Wireless Access and Applications Center (BWAC). Established in 2013 as an NSF Industry/University Cooperative Research Center (I/UCRC), BWAC focuses on addressing fundamental research challenges and developing novel technologies for next-generation wireless systems through collaborative projects involving academia, industry, and government labs. Presently, BWAC consists of five universities (UA as the lead site, Virginia Tech, University of Notre Dame, University of Mississippi, and Catholic University of America) as well as 18 affiliate members from industry and national labs. From 2008 to 2014, Dr. Krunz was the UA site director for “Connection One” (C1), another NSF I/UCRC that focused on wireless circuits and systems, with participation from five universities (UA, ASU, OSU, RPI, and Univ. of Hawaii) and 25+ members from industry and DoD labs. Dr. Krunz is also affiliated with the University Technology Sydney (UTS), Australia, where he holds a courtesy professorship appointment since 2017.

M. Krunz’s research is in the board area of wireless networking and communications, with emphasis on resource allocation strategies, distributed protocol design, and security. Recently, he has been involved in projects related to LTE/5G cellular systems, Wi-Fi protocols, mmWave systems (beam discovery, initial access, phased antenna arrays, wireless backhauling, etc.), cognitive/agile radios, dynamic and shared spectrum access, harmonious coexistence of heterogeneous wireless systems, full-duplex transmissions, ultra-low-latency mobile edge computing (MEC), network slicing, physical-layer wireless security, satellite communications, MIMO systems, energy management in wireless sensor networks, and streaming over wireless links. He previously worked on traffic analysis, packet scheduling, multimedia communications, power control, constraint-based routing, fault detection in optical networks, and others. He coauthored more than 280 published/accepted journal articles and peer-reviewed conference papers, and is a co-inventor of several patents and invention disclosures. His latest h-index is 57 and his total number of citations exceeds 12,000. His research has been funded by NSF, DOD (ARO, AFRL, AFOSR), NASA, Qatar Foundation, South Korea, and several US and international corporations – with a total amount in excess of \$17M. His grants include 23 competitive NSF awards, 17 of which he served as the sole or lead PI.

M. Krunz received numerous awards and recognitions. He is an IEEE Fellow (class of 2010), Arizona Engineering Faculty Fellow (2011-2014), and IEEE Communications Society Distinguished Lecturer (2013 and 2014). In 2012, he received the Outstanding Service Award of IEEE Communications Society’s Technical Committee on Communications “in recognition of consistent high-quality service to TCCC, including leadership in organization of top conferences and sustained editorial service for journals that are central to TCCC” (one such award was given in 2012). In 2010, he received the prestigious Visiting Chair of Excellence (“Catedra de Excelencia”) from the University of Carlos III de Madrid, Spain, following a worldwide selection process that culminated in one US awardee and four awardees from the rest of the world in all academic fields. In 2011, he was awarded a Fulbright Senior Specialist, allowing him to visit with King Abdullah II School of Information Technology at the University of Jordan. Starting 2017, he was appointed as the Editor-in-Chief for the IEEE Transactions on Mobile Computing (TMC), the top journal in the field of wireless and mobile networking. Dr. Krunz was a recipient of the NSF CAREER award (1998-2002). He received the best-paper award of the ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWim’18) and the 2007 International Conference on Cognitive Radio Oriented Wireless Networks and Communications (CrownCom’07). He also was a runner-up for the best-paper award of several other conferences. He was invited as a researcher/distinguished faculty on short-term visits (1–6 months) by numerous universities and research labs, including University Technology

Sydney, Australia (2016–2018), University of Paris V (2013), INRIA-Sophia Antipolis, France (2011, 2008, and 2003), University of Paris VI (2006), HP Labs, Palo Alto (2003), US West Advanced Technologies (1997), and others. In 1994 and during his Ph.D. studies, M. Krunz received the International Thoman Fellowship Award for Outstanding Doctoral Candidates at Michigan State University.

Besides his current role as the EiC for TMC, Dr. Krunz previously served on the editorial boards of several premier journals. He was an editor for the IEEE Transactions on Cognitive Communications and Networking (2015–2018), IEEE Transactions on Network and Service Management (2010-2014), IEEE Transactions on Mobile Computing (2006-2011), IEEE/ACM Transactions on Networking (2001–2008), International Journal of Distributed Sensor Networks (2013-2014), and Computer Communications Journal (2001-2011). He was a guest co-editor for special issues in IEEE magazines. Dr. Krunz chaired numerous top-tier international conferences in the field of mobile networking and communications. He served as a general chair for the 2012 ACM Conference on Wireless Network Security (WiSec'12) and the general vice-chair for the WiOpt 2016 Conference. He chaired the technical program committee (TPC) of Hot Interconnects Symposium 2001, INFOCOM 2004, SECON 2005, WoWMoM 2006, and WCNC 16 (Networking Track). He was an Area TPC chair for INFOCOM'10 and INFOCOM'11. He served and continues to serve on the steering committees of several conferences, journals, and strategic research forums, including the Research Coordination Network on mmW research (mmW-RCN). Funded by NSF, mmW-RCN aims at accelerating cross-disciplinary mmW research by providing a global platform for collaboration between academia, industry, and government agencies involved in this critical area, with emphasis on prototype development, standardization, and product rollouts. Currently, mmW-RCN membership includes 30+ universities, 20+ companies, as well as representatives from many government agencies (NSF, DARPA, ONR, ARO, AFOSR, FCC, and NTIA), the National Spectrum Consortium, 5G PPP (from the EU), and 10+ international collaborating teams. M. Krunz hosted and co-organized the 3rd mmW-RCN workshop in Tucson, AZ (Jan. 2018).

Dr. Krunz was an invited keynote speaker at numerous conferences and workshops, including UNET'15, ICCSP'15, CRESS 2014 (1st IEEE International Workshop on Cognitive Radio and Electromagnetic Spectrum Security), CCW 2012, IFIP Wireless Days 2011, and WiMesh 2009. He served on the 2015 IEEE Fellows Evaluation Committee (Computer Society). He was a panelist and panel moderator at various international conferences, including WCNC 2016, INFOCOM 2009, and SECON 2009. He served as a proposal reviewer and panelist for several funding agencies (NSF, ARO, AAAS, Science Foundation Ireland, etc.), and was invited to speak and organize panels on funding priorities at workshops run by these agencies. He gave tutorials at premier wireless networking conferences such as MobiCom and MobiHoc. Under his directorship, 25 Ph.D. dissertations and M.S. theses were completed. He mentored several junior faculty members and postdoctoral researchers. Dr. Krunz is also an entrepreneur, and has been involved in two startups. He frequently consults for companies in telecommunications and the wireless industry.

## 1 Education

- **Ph.D. in Electrical Engineering (09/92 – 07/95)**  
Michigan State University, East Lansing, Michigan
- **M.S. in Electrical Engineering (01/91 – 07/92)**  
Michigan State University, East Lansing, Michigan
- **B.S. in Electrical Engineering (09/85 – 06/90)**  
University of Jordan, Amman, Jordan

## 2 Professional Experience

### 2.1 Academic Employment History

- **Kenneth VonBehren Endowed Professor**, Dept. of Electrical & Computer Engineering, University of Arizona (2015 – present)
- **Professor**, Department of Electrical & Computer Engineering, Univ. of Arizona (2006 – present)
- **Professor**, Department of Computer Science, University of Arizona (2009 – present)
- **Center and UA site director**, NSF Broadband Wireless Access Center (2018 – present)
- **Site Co-director**, NSF Broadband Wireless Access Center (July 2013 – Aug. 2018)
- **Site Director**, NSF Connection One Center, University of Arizona (Feb. 2008 – June 2014)
- **Associate Professor**, Department of Electrical & Computer Engineering, University of Arizona (Jan. 2002 – June 2006)
- **Assistant Professor** Department of Electrical & Computer Engineering, University of Arizona (1997 – 2002)
- **Postdoctoral Research Associate**, Department of Computer Science and Institute for Advanced Computer Studies (UMIACS), University of Maryland, College Park (Sep. 1995 – Dec. 1996)
- **Graduate Research Assistant**, Michigan State University, East Lansing, Michigan (1991 – 1995)

### 2.2 Invited Visiting Positions

- **Visiting Professor** (October 2016)  
School of Electrical and Data Engineering, University Technology Sydney  
Sydney, Australia
- **Visiting Professor** (Summer 2013)  
University of Paris Descartes (Paris 5), LIPADE Group  
Paris, France
- **Visiting Professor** (July & Aug. 2011)  
King Abdullah II School of Information Technology, University of Jordan  
Amman, Jordan

- **Invited Research Professor** (June 2011)  
Planète group, French National Institute for Research in Computer Science and Control (INRIA)  
Sophia Antipolis, France
- **Visiting Chair of Excellence** (March 2010 – August 2010)  
University of Carlos III de Madrid and IMDEA Networks Research Institute  
Madrid, Spain
- **Invited Research Professor** (July 2008)  
MAESTRO group, French National Institute for Research in Computer Science and Control (INRIA)  
Sophia Antipolis, France
- **Invited Professor** (May/June 2006)  
Laboratoire d'Informatique de Paris 6, University Pierre et Marie Curie (Paris VI)  
Paris, France
- **Invited Visiting Researcher** (Nov. 2003)  
Mobile & Multimedia Streaming Group, HP Labs  
Palo Alto, California
- **Invited Research Professor** (April 2003–Aug. 2003)  
MISTRAL Group, French National Institute for Research in Computer Science and Control (INRIA)  
Sophia Antipolis, France
- **Visiting Scientist** (July 98–Aug. 98)  
Advanced Technologies, US West (now a part of CenturyLink)  
Boulder, Colorado

### 3 Honors, Recognition, and Awards

- Kenneth VonBehren Endowed Professor, University of Arizona (August 2015 – present).
- IEEE Fellow, 2010.
- IEEE Communications Society Distinguished Lecturer (2013 and 2014).
- IEEE Communications Society Technical Committee on Communications Outstanding Service Award (one award given in 2012).
- Arizona Engineering Faculty Fellow (2011–2014)
- Chair of Excellence (“Catedra de Excelencia”), University of Carlos III de Madrid, 2011 (one US awardee selected in that year).
- Editor-in-Chief, IEEE Transactions on Mobile Computing (2017 – present).
- Fulbright Senior Specialist Award, 2011.
- Best-paper award, *ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWim'18)*, for the paper “FastLink: An efficient initial access protocol for millimeter wave systems,” (coauthored with Irmak Aykin), Oct. 2018.

- Best student-paper award, *International Conference on Cognitive Radio Oriented Wireless Networks and Communications (CrownCom 2007)*, for the paper “Price-based spectrum management in cognitive radio networks,” (coauthored with Fan Wang and Shuguang Cui), Aug. 2007.
- NSF CAREER award, 1998.
- Mentor, Outstanding Graduate Student Award (Mohammad J. Abdel-Rahman, Ph.D. in ECE, 2014, University of Arizona).
- Coauthored paper “Exploiting frame preamble waveforms to support new physical-layer functions in OFDM-based 802.11 systems,” was selected by the IEEE COMSOC as a Tech Focus paper on prototyping wireless networks, 2018.
- Runner-up for best-paper award, *WiOpt 2014 Symposium* (4 finalists selected from 167 submissions) for the paper “On the throughput of full-duplex MIMO in the multi-link case,” coauthored with Diep Nguyen and Stephen Hanly.
- Runner-up for for best-paper award, IEEE 2005 Technical Committee on Multimedia Communication for the paper “A playback-adaptive approach for video streaming over wireless networks” (co-authored with M. Hassan), *Proc. of the IEEE GLOBECOM 2005 Conference - Wireless Communication Symposium*.
- International Thoman Fellowship Award for Outstanding Doctoral Candidates, 1994.
- ASAI Scholarship, ASAI Association (1992–1995).
- Michigan State University Summer Graduate Fellowship, 1995.

## 4 Research Interests

- Wireless networking with emphasis on protocol design and resource allocation in 4G/5G cellular systems, Wi-Fi, WLANs, IoT and sensor networks.
- mmWave communications, with emphasis on phased antenna arrays, analog/digital beamforming, massive MIMO, initial access and discovery, tracking, channel characterization, and wireless backhaul.
- Wireless security, with emphasis on PHY-layer security, selective and insider attacks, fingerprint-free communications, transmission obfuscation, adaptive frequency hopping, etc.
- MIMO systems, including applications security and multi-link communications.
- Dynamic and shared spectrum access over licensed and unlicensed.
- In-band full-duplex communications.
- Ultra-low-latency mobile edge computing, network slicing, and applications in connected and autonomous vehicles.
- Energy management and coordination mechanisms (coverage, sleep-mode scheduling, localization, etc.) for wireless sensor networks.
- Space and satellite communications, with emphasis on proactive sensing for interference mitigation, dynamic frequency hopping, network discovery under jamming, and drone communications.

[Previous interests/projects include, among others, media streaming, teletraffic analysis, packet scheduling, constraint-based routing, failure detection in all-optical networks]

## 5 Research Grants and Contracts

PI or Co-PI on tens of federal, industry, and foreign-government grants/contracts, totaling more than \$17M; personally responsible for  $\sim$  \$9M of this amount. Grants include 23 highly competitive NSF awards (PI for 17 of these). A subset of these grants/contracts is listed below in reverse chronologically order:

- “Secure Cloud Storage Verification Methods,” National Science Foundation, Aug. 2018 – July 2021 (\$500K, co-PI, in collaboration with Loukas Lazos and Bane Vasic).
- “Phase II IUCRC University of Arizona: Broadband Wireless Access and Applications Center (BWAC),” National Science Foundation, Oct. 2018 – Sep. 2023 (\$555,550, PI and center director, in collaboration with Tamal Bose).
- “Secure and Fair Spectrum Sharing for Heterogeneous Coexistent Systems,” National Science Foundation, Oct. 2017 – Sep. 2020 (\$600K, co-PI, in collaboration with Loukas Lazos and Ming Li).
- Raytheon Corporation – multiple projects through BWAC membership, July 2013 – Aug. 2019 (\$260K, PI, in collaboration with Tamal Bose).
- Keysight Technologies – multiple projects through BWAC membership, July 2013 – Aug. 2019 (\$250K, PI, in collaboration with Tamal Bose).
- Denso Corporation – two projects through BWAC membership, August 2017 – Aug. 2019 (\$90K, PI, in collaboration with Tamal Bose).
- General Dynamics – two projects through BWAC membership, August 2017 – present (\$100K, PI, in collaboration with Tamal Bose).
- Futurewei – one project through BWAC membership, July 2017 – June 2018 (\$40K, co-PI, in collaboration with Ivan Djordevic and Tamal Bose).
- “I/UCRC for Broadband Wireless Access and Applications Center Site at the Catholic University of America,” National Science Foundation – subcontract through CUA, Aug. 2016 – July 2018 (\$120K, co-PI, in collaboration with Tamal Bose).
- “NeTS: Medium: Collaborative Research: Coexistence of Heterogeneous Wireless Access Technologies in the 5 GHz Bands,” National Science Foundation, Aug. 1, 2016 – July 31, 2020 (in collaboration with Virginia Tech and Temple University; total amount \$1.1M; UA portion \$375K, PI for the UA award).
- EpiSys Science Inc. – multiple projects through BWAC membership, July 2013– Aug. 2017 (\$126,100, co-PI, in collaboration with Tamal Bose).
- “Dynamic Frequency Hopping Satellite Networks,” NASA Phase-I STTR, 2015 – 2016 (in collaboration with Space Micro; total amount \$125K; UA portion \$60K, PI).
- “Security Beyond Encryption: Physical-layer Techniques for Obfuscating Communication Fingerprints,” Qatar National Research Fund, Feb. 2016 – June 2019 (in collaboration with Ali Ghayeb, Texas A&M University Qatar; total amount \$693,247; UA portion \$277,561, PI).
- “NeTS: Medium: Reconfigurable Antennas and Optimized Multi-channel MIMO Designs for DSA Systems with a Broad Frequency Coverage,” National Science Foundation, Sep. 2015–Aug. 2019 (\$800K, PI, in collaboration with Hao Xin).

- Space Micro – a project through BWAC membership (entitled “Game-theoretic Frequency/Waveform Adaption in Satellite Systems”), Aug. 2013 – July 2014 (\$40K, PI).
- “I/UCRC FRP: Exploiting Self-interference Suppression and Full-duplex Capabilities in Opportunistic Wireless Systems,” National Science Foundation, Sep. 2015–Aug. 2017 (\$200K, PI, in collaboration with Tamal Bose).
- “I/UCRC: Collaborative Research: Broadband Wireless Access & Applications Center,” National Science Foundation, Sep. 2013 – August 2018 (\$686,821, co-PI and site co-director, in collaboration with Tamal Bose and Haris Volos).
- “TWC: Medium: Leakage of Communications Signatures: Analysis of Eaves Attacks and Proactive Countermeasures,” National Science Foundation, Oct. 2014–Sep. 2018 (\$660K, PI, in collaboration with L. Lazos).
- Rincon Research Corporation – three projects through BWAC membership, July 2013–Aug. 2016 (\$120K, co-PI, in collaboration with Tamal Bose).
- “FRP: Collaborative Research: Coexistence of Heterogeneous Secondary Networks for Shared Spectrum Access,” National Science Foundation, August 2014 – July 2016 (\$200K, PI, in collaboration with Virginia Tech.).
- “COHERENT: COgnitive HEterogenous wiREless Network Testbed,” (DURIP Grant), AFOSR, Sep. 2013 – Sep. 2014 (\$320K, PI, in collaboration with T. Bose, H. Volos, and H. Xin).
- “Blinding Eve: Methods for Concealing Wireless Communications in Mobile Coalitions,” Army Research Office (ARO), Aug. 2013 – July 2016 (\$460K, PI, in collaboration with Loukas Lazos).
- “Optimal Sensing, Resource Allocation, and Protocol Design for Real-time Communications in Dynamic Spectrum Access Networks,” Qatar National Research Fund, Jan. 2013 – Sep. 2015 (in collaboration with Qatar University, Qatar, and Nile University, Egypt; total award \$1,035,000; UA portion \$201,400; lead PI).
- “Rendezvous Protocols and Dynamic Frequency Hopping Designs for Anti-Jamming Satellite Communications,” Air Force Research Lab., May 2012–June 2013 (\$50K, PI, in collaboration with Ricardo Sanfelice).
- “Collaborative Research: Cognitive MIMO Communications for Dynamic-spectrum Wireless Networks,” National Science Foundation, Aug. 2012–July 2014 (\$200K, PI, in collaboration with Sayfe Kiaei, ASU).
- “TC: Small: Enemies from Within: Thwarting Sophisticated Insider Attacks in Wireless Networks,” National Science Foundation, July 2010–July 2013 (\$499,535, co-PI, in collaboration with Loukas Lazos).
- “NeTS: Medium: Collaborative Research: Exploiting Battery-Supply Nonlinearities in Optimal Resource Management and Protocol Design for Wireless Sensor Networks,” National Science Foundation, Sep. 2009–Aug. 2012 (in collaboration with Sarma Vrudhula, ASU; total amount \$550K; UA portion \$340,000; PI).
- “Incorporating STAR Capabilities in the Design of Channel Access Protocols,” Raytheon Corporation – project through the Connection One Center, July 2012–June 2013 (\$50K, PI).



- “Interference and Jamming Mitigation in Satellite Communications Using Spectrum Sensing and Dynamic Frequency Hopping,” AFRL, April 2011–Dec. 2011 (\$50K, PI).
- “Cognitive Radio Spectrum Management and Waveform Adaptation for High-Capacity Satellite Communications,” Phase-I Air Force STTR, June 2012–Feb 2013 (total amount \$100K, in collaboration with Space Micro).
- “Protocols for Virtual MIMO in Multi-hop Wireless Sensor Networks,” Raytheon Corporation – project through the Connection One Center, July 2011–June 2012 (\$50K, PI).
- “Modeling and Prediction of Battery Lifetime in Wireless Sensor Nodes,” Raytheon Corporation, Sep. 2010–July 2011 (\$50K, PI).
- Analog Devices Inc. – three projects through the Connection One Center, July 2008–June 2011 (\$150K, PI).
- Hydronalix – two projects through the Connection One Center, July 2011–June 2013 (\$100K, PI, in collaboration with Ricardo Sanfelice).
- “Securing Control Communications in Spectrum-Agile Wireless Networks,” Raytheon Corporation – a project through the Connection One Center, July 2010–June 2011 (\$50K, PI).
- “Radio Frequency Characterization of Composites and Meta-materials for Novel 3D Circuit Applications” National Science Foundation, (\$200K, PI, in collaboration with Kathie Melde from the UA and John Volakis from Ohio State Univ.; UA portion \$100K).
- “Efficient Mechanisms for Sequential Channel Sensing/Probing in Practical CR Systems under Sensing Inaccuracies,” Raytheon Corporation – a project through Connection One Center, Sep. 2009–July 2010 (\$50K, PI).
- “Design of a Transport Layer for Reliable Delivery in Multi-hop RAFAR Networks,” Raytheon Corporation, Sep. 2009–Aug. 2010 (\$80K, PI).
- “Connection One: Telecommunication Circuits and Systems (I/UCRC),” National Science Foundation, July 2008–June 2014 (\$150K, PI).
- “NeTS-WN: Cross-layer Optimizations and Adaptive Protocols For Opportunistic and Collaborative Cognitive Radio Networks,” National Science Foundation, Sep. 2007–Aug. 2010 (\$345,394 PI, in collaboration with Shuguang Cui).
- Texas Instruments (TI) - two projects through the Connection Once Center, Aug. 2008 – July 2010 (\$100K, PI).
- “Interference-aware Routing and Flow-based Reservation for Multi-hop Cognitive Radio Networks,” Raytheon Corporation – a project through the Connection One Center, Sep. 2008–Aug. 2009 (\$50K, PI).
- “Securing Opportunistic Spectrum Access in Cognitive Radio Networks,” BAE Systems – a project through the Connection One Center, Sep. 2008–Aug. 2009 (\$50K, PI, in collaboration with Loukas Lazos).
- “Cross-layer Routing and Channel Access Mechanisms for Multi-hop Wireless RAFAR Networks in Mobile Scenarios,” Raytheon Corporation, Sep. 2007–July 2008 (\$80K, PI).

- “Forward Error Correction Codes and Protocols for Next Generation Optical Networks,” National Science Foundation - ITR/Group, Sep. 2003–Aug. 2008 (\$2.5K, co-PI, in collaboration with B. Vasic, R. Kostuk, S. Ramasubramanian, and D. Geraghty).
- “NeTS-ProWin: Resource Management and Distributed Protocols for Heterogeneous Cognitive Radio Networks,” National Science Foundation, Sep. 2006–Oct. 2007 (\$125K, PI, in collaboration with Shuguang Cui).
- “Dynamic Spectrum Adaptation in Wireless Packet Networks” – Raytheon Corporation – project through the Connection One Center, Aug. 2006–Sep. 2007 (\$60K, PI, in collaboration with Shuguang Cui).
- “Design and Evaluation of Transmission Power Control for Raytheon Advance Frequency Agile Radio (RAFAR) Networks,” Raytheon Corporation, Sep. 2006–Aug. 2007 (\$40K, PI).
- “Stateless Quality of Service Routing in IP Networks,” National Science Foundation - ITR, Sep. 2003–Aug. 2007 (\$350K, PI).
- “U.S.-Jordan Cooperative Research: Integrated Design of Channel Codes and Bandwidth Management Schemes for Optical Networks,” National Science Foundation, August 2004–July 2007 (\$19,400, PI).
- “A Control Theoretic Approach to The Design of Internet Traffic Managers,” National Science Foundation - Special Projects in Networking Research, Sep. 2001–Aug. 2005 (in collaboration with Ibrahim Matta and Azer Bestavros, Boston University; total amount \$1,037,000; UA portion \$337,000; PI for UA award).
- “Integrated Design of Next Generation Broadband Mobile Networks: Antennas, Codes, and Protocols,” National Science Foundation – Wireless Communications Initiative, Oct. 1999–Sep. 2003 (\$450K, co-PI, in collaboration with B. Ryan, M. Marcellin, and K. Virga).
- “Query Time Estimation and Adaptive Throughput Performance Improvement,” Raytheon Corporation, 2004/2005 (\$150K, PI).
- “CAREER: Traffic Characterization and Resource Allocation for Transporting Video Streams Over Broadband Networks,” National Science Foundation, March 1998–Aug. 2002 (\$205K, PI).
- “Adaptive Encapsulation of IP Traffic Within Ethernet Frames Subject to Delay Guarantees,” Raytheon Corporation, 2002 (\$69K, PI).
- “Adaptive Ethernet Improved Bandwidth and QoS Technology Demonstrator,” Raytheon Corporation, 2003 (\$65K, PI).
- UA/ASU Center for Low Power Electronics, 2001–2005 (\$120K, PI).
- “Video Transmission Over Wireless Networks,” UA/ASU Grant Collaboration, funded through Proposition 301, 2002 (UA portion \$16,000, PI).
- “A framework for Statistical Performance Guarantees in Heterogeneous Networks,” Faculty Grant Award, Office of the VP for Research, University of Arizona, 1997/1998 (\$4,500, PI).

## 6 Publications

### Articles (accepted or published only)

1. Yong Xiao, Marwan Krunz, and Tao Shu, “Multi-operator network sharing for massive IoT,” accepted for the *IEEE Communications Magazine – Mobile Communications and Networks Series*, 2019.
2. Berk Akgun, Marwan Krunz, and Ozan Koyluoglu, “Vulnerabilities of massive MIMO systems to pilot contamination attacks,” *IEEE Transactions on Information Forensics & Security*, vol. 14, no. 5, pp. 1251–1263, May 2019.
3. Peyman Siyari, Marwan Krunz, and Diep Nguyen, “Distributed power control in single-stream MIMO wiretap interference networks with full-duplex jamming receivers,” *IEEE Transactions on Signal Processing*, vol. 67, issue 3, pp. 594–608, Feb. 2019.
4. Mohammed Hirzallah, Wessam Afifi, and Marwan Krunz, “Provisioning QoS in Wi-Fi systems with asymmetric full-duplex communications,” *IEEE Transactions on Cognitive Communications and Networking*, vol. 4, issue 4, pp. 942–953, Dec. 2018.
5. Bushra Ismaiel, Mehran Abolhasan, Wei Ni, David Smith, Daniel Franklin, Eryk Dutkiewicz, Marwan Krunz, and Abbas Jamalipour, “PCF-based LTE Wi-Fi aggregation for coordinating and offloading the cellular traffic to D2D network,” *IEEE Trans. on Vehicular Technology*, vol. 67, issue 12, pp. 12193–12203, Dec. 2018.
6. Yong Xiao and Marwan Krunz, “Dynamic network slicing for scalable fog computing systems with energy harvesting,” *IEEE Journal on Selected Areas in Communications (JSAC) – Special issue on Scalability Issues and Solutions for Software Defined Networks*, vol. 36, issue 12, pages 2640–2654, Dec. 2018.
7. Yong Xiao and Marwan Krunz, “Distributed optimization for energy-efficient fog computing in the tactile Internet,” *IEEE Journal on Selected Areas in Communications (JSAC) – Special issue on Emerging Technologies in Tactile Internet and Backhaul/Fronthaul Networks*, vol. 36, issue 11, pages 2390–2400, Nov. 2018.
8. Yong Xiao, Mohammed Hirzallah, and Marwan Krunz, “Distributed resource allocation for network slicing over licensed and unlicensed bands,” *IEEE Journal on Selected Areas in Communications (JSAC) – Special Issue on Network Softwarization & Enablers*, vol. 36, issue 10, pages 2260–2274, Oct. 2018.
9. Peyman Siyari, Marwan Krunz, and Diep Nguyen, “Power games for secure communications in single-stream MIMO interference networks,” *IEEE Transactions on Wireless Communications*, vol. 17, issue 9, pp. 5759–5773, Sep. 2018.
10. Diep Nguyen, Eryk Dutkiewicz, and Marwan Krunz, “Harvesting short-lived white spaces via opportunistic traffic offloading between mobile service providers,” *IEEE Transactions on Cognitive Communications and Networking (TCCN)*, vol. 4, issue 3, pp. 635–647, Sep. 2018.
11. Diep Nguyen, Marwan Krunz, and Eryk Dutkiewicz, “Full-duplex MIMO Radios: A greener networking solution,” *IEEE Transactions on Green Communications and Networking (TGCN)*, vol. 2, issue 3, pp. 652–665, Sep. 2018.

12. Irmak Aykin, Marwan Krunz, and Yong Xiao, "Adaptive frequency hopping schemes for CR-based multi-link satellite networks," *International Journal of Satellite Communications and Networking*, vol. 36, issue 4, pp. 315–331, July/Aug. 2018.
13. Wessam Afifi, Mohammad J. Abdel-Rahman, Marwan Krunz, and Allen B. MacKenzie, "Full-duplex or half-duplex: A Bayesian game for wireless networks with heterogeneous self-interference cancellation capabilities," *IEEE Transactions on Mobile Computing*, vol. 17, no. 5, pp. 1076–1089, May 2018.
14. Zaheer Khan, Janne Lehtomaki, Simon Scott, Zhu Han, Marwan Krunz, and Alan Marshall, "Distributed and coordinated spectrum access methods for heterogeneous channel bonding," *IEEE Transactions on Cognitive Communications and Networks (TCCN)*, vol. 3, no. 3, pp. 267–281, Sep. 2017.
15. Hanif Rahbari and Marwan Krunz, "Exploiting frame preamble waveforms to support new physical-layer functions in OFDM-based 802.11 systems," *IEEE Transactions on Wireless Communications*, vol. 16, no. 6, pp. 3775–3786, June 2017.
16. Wessam Afifi and Marwan Krunz, "TSRA: An adaptive mechanism for switching between communication modes in full-duplex opportunistic spectrum access systems," *IEEE Transactions on Mobile Computing*, vol. 16, issue 6, pp. 1758–1772, June 2017.
17. Jocelyne Elias, Fabio Martignon, Lin Chen, and Marwan Krunz, "Distributed spectrum management in TV white space networks," *IEEE Transactions on Vehicular Technology*, vol. 66, issue 5, pp. 4161–4172, May 2017.
18. Peyman Siyari, Marwan Krunz, and Diep Nguyen, "Friendly jamming in a MIMO wiretap interference network: A nonconvex game approach," *IEEE Journal on Selected Areas in Communications (JSAC) – Special Issue on Game Theory for Networks*, vol. 35, issue 3, pp. 601–614, March 2017.
19. Alejandro Proano, Loukas Lazos, and Marwan Krunz, "Traffic decorrelation techniques for countering a global eavesdropper in WSNs," *IEEE Transactions on Mobile Computing (TMC)*, vol. 16, issue 3, pp. 857–871, March 2017.
20. Berk Akgun, O. Ozan Koyuoglu, and Marwan Krunz, "Exploiting full-duplex receivers for achieving secret communications in multiuser MISO networks," *IEEE Transactions on Communications*, vol. 65, issue 2, pp. 956–968, Feb. 2017.
21. Mohammed Hirzallah, Wessam Afifi, and Marwan Krunz, "Full-duplex-based rate/mode adaptation strategies for Wi-Fi/LTE-U coexistence: A POMDP approach," *IEEE Journal on Selected Areas in Communications (JSAC) – Special Issue on Spectrum Sharing and Aggregation for Future Wireless Networks*, vol. 35, no. 1, pp. 20–29, Jan. 2017.
22. Hanif Rahbari and Marwan Krunz, "Full frame encryption and modulation obfuscation using channel-independent preamble identifier," *IEEE Transactions on Information Forensics & Security*, vol. 11, issue 12, pp. 2732–2747, Dec. 2016.
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## Conference Papers (peer-reviewed only)

Note: Acceptance Rate (**AR**) is provided when known

1. Peyman Siyari and Marwan Krunz, "Linear precoding with friendly jamming in overloaded MU-MIMO wiretap networks," accepted for the *IEEE CNS 2019 Conference*, Washington D.C., June 2019.
2. Mohammed Hirzallah, Yong Xiao, and Marwan Krunz, "MatchMaker: An inter-operator network sharing framework in unlicensed bands," accepted for the *IEEE SECON 2019 Conference*, Boston, June 2019.
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4. Jing Hou, Li Sun, Tao Shu, Yong Xiao, and Marwan Krunz, "Strategic network infrastructure sharing through backup reservation in a competitive environment," accepted for the *IEEE SECON 2019 Conference*, Boston, June 2019.
5. Irmak Aykin, Berk Akgun, and Marwan Krunz, "Smartlink: Exploiting channel clustering effects for reliable millimeter wave communications," accepted for the *IEEE INFOCOM 2019 Conference*, Paris, France, April/May 2019 (AR = 19.7%).
6. Irmak Aykin and Marwan Krunz, "FastLink: An efficient initial access protocol for millimeter wave systems," *Proc. of the ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM 2018)* – full paper, Montreal, Canada, Oct. 2018 (**received best-paper award**).
7. Mohammed Hirzallah, Yong Xiao, and Marwan Krunz, "On modeling and optimizing LTE/Wi-Fi coexistence with prioritized traffic classes," *Proc. of the IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN'18)* – "long" paper, October 2018, Seoul, South Korea.
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14. Berk Akgun, Marwan Krunz, and O. Ozan Koyluoglu, "Pilot contamination attacks in massive MIMO systems," *Proc. of the IEEE CNS 2017 Conference*, Las Vegas, Oct. 2017.
15. Peyman Siyari, Marwan Krunz, and Diep Nguyen, "Joint transmitter- and receiver-based friendly jamming in a MIMO wiretap interference network," *Proc. of the IEEE ICC 2017 Conference – Workshop on Full-Duplex Communications for Future Wireless Networks*, Paris, May 2017.
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148. George Apostolopoulos, Marwan Krunz, and Satish K. Tripathi, "Supporting interactive scanning operations in VOD systems," in *Proceedings of the ACM/SPIE Multimedia Computing and Networking Conference*, pp. 84-95, Jan. 1998.
149. Marwan Krunz and Satish K. Tripathi, "On the characterization of VBR MPEG streams", in *Proceedings of ACM SIGMETRICS '97 Conference*, pp. 192-202, June 1997.
150. Marwan Krunz and Satish K. Tripathi, "Exploiting the temporal structure of MPEG video for the reduction of bandwidth requirements," *Proceedings of the IEEE INFOCOM '97 Conference*, pp. 67-74, April 1997, Kobe, Japan.
151. Ibrahim Matta and Marwan Krunz, "Packing and least-loaded based routing in multi-rate loss networks," *Proceedings of the IEEE ICC '97 Conference*, June 1997, Montreal, Canada.
152. Wei Zhao, Marwan Krunz and Satish K. Tripathi, "Efficient transport of stored video using stream scheduling and window-based traffic envelopes," *Proceedings of the IEEE ICC '97 Conference*, June 1997, Montreal, Canada.
153. Marwan Krunz and Satish K. Tripathi, "Bandwidth allocation for multiplexed VBR video streams with deterministic guarantees," *Proceedings of the 2nd IEEE ATM Workshop '96*, San Francisco, Aug. 1996.
154. Marwan Krunz, Satish K. Tripathi, and Herman Hughes, "A source model for MPEG-coded video movies (extended abstract)," *Proceedings of the 1st IEEE Workshop on ATM Networks*, Washington D.C., October 1995.
155. Marwan Krunz and Herman Hughes, "A traffic model for MPEG-coded VBR streams," *Proceedings of the ACM SIGMETRICS '95 Conference*, pp. 47-55, 1995.
156. Marwan Krunz, Ron Sass, and Herman Hughes, "Statistical characteristics and multiplexing of MPEG streams," *Proceedings of the IEEE INFOCOM '95 Conference*, pp. 455-462, April 1995.
157. Marwan Krunz and Herman Hughes, "A performance study of loss priorities for MPEG video traffic," *Proceedings of the IEEE Int. Conference on Communications (ICC '95)*, pp. 1756-1760, June 1995.
158. Marwan Krunz, Herman Hughes, and Parviz Yegani, "Design and analysis of a buffer management scheme for multimedia traffic with loss and delay priorities," *Proceedings of the IEEE GLOBECOM '94 Conference*, pp. 1560-1564, San Francisco, November 1994.
159. Parviz Yegani, Marwan Krunz, and Herman Hughes, "Congestion control schemes in prioritized ATM networks," *Proceedings of the IEEE Int. Conf. on Communications (ICC '94)*, pp. 1169-1173, New Orleans, May 1994.
160. Marwan Krunz, Herman Hughes, and Parviz Yegani, "Traffic control in ATM switching using multiple buffers and Nested Threshold Cell Discarding," *Proceedings of the Second Int. Conference on Computer Communications and Networks (IC3N)*, pp. 69-73, June 1993.
161. Marwan Krunz, Herman Hughes, and Parviz Yegani, "Congestion control in ATM networks using multiple buffers and priority mechanisms," *Proceedings of the Summer Computer Simulation Conference (SCS)*, pp. 566-571, Boston, July 1993

162. Majid Nayeri, John Deller, and Marwan Krunz, "Convergence and colored noise issues in bounding ellipsoid identification," *Proceedings of the IEEE Int. Conference on Acoustics, Speech and Signal Processing (ICASSP '92)*, vol. 5, pp. 337–340, March 1992.

## Book Chapters

1. Alaa Muqattash, Marwan Krunz, and Sung-Ju Lee, "A Perspective on the design of power control for mobile ad hoc networks," in *Mobile Wireless and Sensor Networks: Technology, Applications and Future Directions*, pp. 73–104, Editors R. Shorey, C. M. Choon, O. W. Tsang, and A. Ananda, John Wiley & Sons, Inc., 2006.
2. P. Van Mieghem, F. A. Kuipers, T. Korkmaz, M. Krunz, M. Curado, E. Monteiro, X. Masip-Bruin, J. Sole-Pareta, and S. Sanchez-Lopez, "Quality of service routing," COST 263 Book, Chapter 2, pp. 80 – 117, editors M. Smirnov et al. (published by Springer Verlag).
3. Marwan Krunz, "Statistical multiplexing," *Encyclopedia of Electrical and Electronics Engineering*, Vol. 20, pp. 479 – 492, Ed. John Webster, John Wiley & Sons, Inc., April 1999.

## 7 Poster Presentations (last few years)

- Irmak Aykin, Berk Akgun, and Marwan Krunz, "Multi-lobe beam searching for initial access in mmWave systems," NSF RCN Meeting, Univ. of Arizona, Jan. 2018.
- Hanif Rahbari, Jerry Park, and Marwan Krunz, "Designing frame preambles for initializing security functions," NSF BWAC Meeting, Univ. of Notre Dame, Oct. 2017.
- Irmak Aykin and Marwan Krunz, "Directional network discovery in mmW systems," NSF RCN Meeting, Univ. of WisconsinMadison, July 2017.
- Irmak Aykin and Marwan Krunz, "Efficient beam finding and tracking in mmW systems," NSF BWAC Meeting, Virginia Tech., May 2017.
- Yong Xiao and Marwan Krunz, "Inter-operator carrier aggregation for next-generation wireless networks," NSF BWAC Meeting, November 2016.
- Wessam Afifi and Marwan Krunz, "Enabling media streaming over LTE-U small cells," NSF BWAC Meeting, Tucson, March 2016 (**received best-poster award**).
- Mohammed Hirzallah, Wessam Afifi, and Marwan Krunz, "Spectrum sensing and interference mitigation for LTE/WiFi coexistence," NSF BWAC Meeting, Tucson, March 2016.
- Berk Akgun, O. Ozan Koyluoglu, and Marwan Krunz, "Exploiting full-duplex receivers for achieving secret communications in multiuser MIMO systems," NSF BWAC Meeting, Tucson, March 2016.
- Irmak Aykin, Mohammad Abdel-Rahman, and Marwan Krunz "Proactive sensing and interference mitigation for satellite communications using dynamic frequency hopping," NSF BWAC Meeting, Univ. of Mississippi, Oxford, Nov. 2015 (**received best-poster award**).
- Wessam Afifi and Marwan Krunz, "Opportunistic spectrum access systems with self-interference suppression capabilities," NSF BWAC Meeting, Univ. of Notre Dame, April 2015.



- Hanif Rahbari and Marwan Krunz, “Leakage of communications signatures: Analysis of eavesdropping attacks and proactive countermeasures,” NSF SaTC PI Meeting, Washington DC, Jan. 2015.
- Hanif Rahbari and Marwan Krunz, “Energy-efficient jamming attacks on channel and frequency offset estimation in wireless systems,” NSF BWAC Meeting, Blacksburg, VA, May 2014.
- Manjesh Hanawal and Marwan Krunz, “Game theoretic frequency/waveform adaptation in satellite systems,” NSF BWAC Meeting, Auburn, AL, Oct. 2013.
- Mohammad J. Abdel Rahman and Marwan Krunz, “Rendezvous under smart jamming,” NSF BWAC Meeting, Auburn, AL, Oct. 2013.
- Mohammad J. Abdel Rahman, Hanif Rahbari, and Marwan Krunz, “Anti-jamming frequency hopping techniques for secure multicast communications,” NSF BWAC Meeting, Tucson, AZ, April 2013.
- Marwan Krunz and Wessam Afifi, “Exploiting self-interference suppression in the design of wireless networks,” NSF BWAC Meeting, Tucson, AZ, April 2013 (received best student-poster award).
- Mohammad J. Abdel Rahman, Marwan Krunz, and Diep Nguyen, “Frequency and waveform adaptation strategies for countering smart adversaries in satellite systems,” NSF BWAC Meeting, Tucson, AZ, April 2013.
- Junseok Kim and Marwan Krunz, “Incorporating simultaneous transmit/receive capabilities in the design of channel access protocols,” NSF Connection One Semi-annual Meeting, Tucson, Jan. 2013.
- Marwan Krunz, Ricardo Sanfelice, Mohammad J. Abdel Rahman, and Diep Nguyen, “Game theoretic channel selection and waveform adaptation for anti-jamming satellite systems,” NSF Connection One Semi-annual Meeting, Tucson, Jan. 17-18, 2013.
- Mohammad J. Abdel Rahman, Hanif Rahbari, and Marwan Krunz, “Anti-jamming frequency hopping techniques for secure multicast communications,” Connection One Semi-annual Meeting, Tucson, Jan. 17-18, 2013.
- Marwan Krunz and Ricardo Sanfelice, “Adaptive frequency hopping and synchronization-based algorithms for rendezvous,” *AFRL Cognitive RF Workshop*, Albuquerque, Sep. 2012.
- Mohammad J. Abdel Rahman and Marwan Krunz, “Anti-jamming frequency hopping techniques for secure multicast communications,” *ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec 2012)*, Tucson, Arizona, April 16-18, 2012.
- Marwan Krunz, “Securing control communications in spectrum-agile wireless networks,” *2nd Annual AFRL Workshop on Cognitive and Software-Defined RF Technology*, WP Air Force Base, Dayton, Ohio, Sep. 2011.

## 8 Patents and Invention Disclosures

1. Marwan Krunz, Irmak Aykin, and Berk Akgun, “A method for fast beam sweeping and device discovery in 5G millimeter wave and upper centimeter-wave systems,” U.S. Provisional Patent Application, filed Oct. 5, 2018 (based on Invention Disclosure UA 18-209).
2. Marwan Krunz, Berk Akgun, Peyman Siyari, Hanif Rahbari, Rashad Eleteby, and Onur Ozan Koyluoglu, “Systems and methods for securing wireless communications,” U.S. Utility Patent No. 10,069,592, issued Sep. 4, 2018.

3. Marwan Krunz, Berk Akgun, Peyman Siyari, Hanif Rahbari, Rashad Eletreby, and Onur Ozan Koyluoglu, “Systems and methods for securing wireless communications,” Application no. 16/012,620, filed June 19, 2018 (divisional patent application that extends Patent No. 10,069,592).
4. Marwan Krunz and Hanif Rahbari, “A method for exploiting preamble waveforms to support device and network functionalities in wireless systems,” PCT patent application, filed Feb. 16, 2018.
5. Marwan Krunz and Hanif Rahbari, “A method for exploiting preamble waveforms to support new physical-layer functionalities in wireless systems,” U.S. Provisional Patent Application No. 62/459,886 (NT Ref. No: UNIA 16.55 PROV.), filed February 16, 2017. An earlier version filed as an Invention Disclosure UA16-213, May 9, 2016.
6. Marwan Krunz, Wessam Affi, and Mohammed Hirzallah, “A method for adapting the clear channel assessment threshold to support Wi-Fi/LTE-U coexistence,” Invention Disclosure UA16-228, filed June 21, 2016.
7. Marwan Krunz and Wissam Affi, “A method for improving spectrum sensing and efficiency in cognitive wireless systems,” U.S. Patent Application No. PCT US14/33479, filed April 9, 2014.
8. Antony A. Franklin, Myung Su Song, Jin Suk Pak, Marwan Krunz, and Tao Shu, “Channel allocation method in multi-channel cognitive radio network,” U.S. Patent Application No. 13/314,792, filed Feb. 2012.
9. Phillip Rosengard and Marwan Krunz, “Method and system for encapsulating variable-size packets,” US Patent No. 7376141 (granted May 20, 2008).
10. Phillip Rosengard and Marwan Krunz, “Encapsulating packets into a frame for a network,” US Patent No. 7324522 (granted Jan. 29, 2008).
11. Phillip Rosengard and Marwan Krunz, “Method and system for encapsulating cells,” US patent No. 7013318 (granted March 14, 2006).

## **9 Keynotes, Panels, and Invited Talks**

### **I. Keynote Speaker**

- 17th International Symposium on Communications and Information Technologies (ISCIT 2017), Cairns, Australia, Sep. 2017.
- International Symposium on Ubiquitous Networking (UNet 2015), Casablanca, Morocco, Sep. 2015.
- International Conference on Communications, Signal Processing, and their Applications (ICCSP’15), Sharjah, United Arab Emirates, Feb. 2015.
- First IEEE International Workshop on Cognitive Radio and Electromagnetic Spectrum Security (CRESS 2014), San Francisco, Oct. 2014.
- IEEE Computer Communications Workshop (CCW), Sedona, Nov. 2012.
- IFIP Wireless Days 2011 Conference, Niagara Falls, Canada, Oct. 2011.
- IEEE Workshop on Wireless Mesh Networks (WiMesh 2009), Rome, June 2009.

## II. Invited Panelist and Panel Organizer/Moderator at Conferences/Workshops

- Army Research Office (ARO) Workshop on Dynamic and Proactive Defense in Networked Systems, Tampa, FL, Dec. 2017 (invitation-only workshop; invited panelist; panel title “Vision: Creating proactive and adaptive techniques and methodology in networked systems”).
- 1st NSF Research Coordination Network (RCN) Workshop on Millimeter-wave Systems (mmW-RCN), Washington DC, Dec. 2016 (invited panelist; panel title: “Cross-disciplinary collaboration in mmW research - scoping the landscape and charting a course for RCN contributions”).
- IEEE WCNC 2016 Conference, Doha, Qatar, April 2016 (panel organizer & moderator; panel title “Global research funding opportunities: models & lessons learned”; panelists include program managers from ONR-Global, NSF, Qatar Foundation, and IIT-Kanpur).
- IEEE SECON 2009 Conference, Rome, Italy, June 2009 (panelist; panel title “Cognitive radio networks: Possible paths from research to real world”).
- IEEE INFOCOM 2009 Conference, Rio de Janeiro, Brazil, April 2009 (panel organizer, moderator, and panelist; panel title “Current trends in wireless networks.”)

## III. Invited Speaker at Conferences/Workshops

- International Conference on Computing, Networking and Communications (ICNC 2019), Honolulu, HI, Feb. 2018 (invited talk). Presentation title: “Network Discovery and Tracking in Directional Millimeter-Wave 5G Systems”).
- International Conference on Computing, Networking and Communications (ICNC 2018), Maui, HI, March 2018 (invited distinguished lecturer). Presentation title: “Obfuscation of Transmission Fingerprints for Secure Wireless Communications”).
- International Symposium on Ubiquitous Networking (UNet 2015), Casablanca, Morocco, Sep. 2015.
- AFRL Cognitive RF Workshop, Albuquerque, Sep. 2012.
- Third International Workshop on Measurement, Modeling, and Performance Analysis of Wireless Sensor Networks (SenMetrics 2005), San Diego, July 2005. Presentation title: “Joint power/rate optimization for CDMA-based wireless sensor networks.”
- IEEE Workshop on High Performance Switching and Routing (HPSR 2004), April 2004. Presentation title: “Power control protocol for mobile ad hoc networks.”
- Workshop on MOBILE, WIreless and SENsoR Networks: Technology and Future Directions (MOB-WISER), March 2004, Singapore. Presentation title: “Power controlled MAC protocols for mobile ad hoc networks.”
- 16th IEEE Computer Communications Workshop (CCW), Charlottesville, Virginia, Oct. 14–17, 2001. Presentation title: “Computation of QoS routes in the presence of state inaccuracies.”

## IV. Invited Talks at Universities and Industry/Government Labs (samples)

- Huazhong University of Science and Technology (HUST), Wuhan, China, Oct. 2018.
- L3 Technologies (L3T) – Communications Systems West, Salt Lake City, UT, Oct. 2017

- INRIA – Paris, France, July 2017.
- University Technology Sydney, Australia, School of Computing and Communications, March 2017.
- Iowa State University, ECE Department, Ames, Nov. 2016.
- University Technology Sydney, Australia, School of Computing and Communications, Oct. 2016.
- University of California at San Diego (UCSD), CSE Department, May 2016.
- Huawei Technologies – France Research Center, Paris, France, July 2015.
- University of British Columbia, Vancouver, Canada, Nov. 2013 (IEEE Distinguished Lecture).
- University of Utah, Salt Lake City, Nov. 2013 (IEEE Distinguished Lecture).
- IEEE-Oregon Local Chapter, Portland, Nov. 2013 (IEEE Distinguished Lecture).
- IEEE-Washington Local Chapter, Seattle, Nov. 2013 (IEEE Distinguished Lecture).
- University of Jordan and Princess Sumaya University for Technology (sponsored by the IEEE Jordan section and the IEEE Communications Society Jordan Chapter), Amman, Jordan, July 2013.
- University of Paris Descartes (Paris 5), LIPADE Group Paris, France, June 2013.
- Qatar Texas A&M University, Doha, Qatar, May 2013.
- Computer Science Department, University of California, Davis, Nov. 2011.
- King Abdullah II School of Information Technology, the University of Jordan, Amman, Jordan, July 2011.
- Department of Telecommunications Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, Jordan, June 2011.
- INRIA Sophia Antipolis (Planète team), France, June 2011.
- Air Force Research Lab – Kirtland, May 2010.
- Institute IMDEA Networks (Madrid Institute for Advanced Studies), April 2010.
- Boeing, Networked Systems Technology (November 2009, Invited Speaker).
- Department of Electronic Engineering, Tsinghua University, China (Sep. 2009, Distinguished Speaker).
- Electronics and Telecommunications Research Institute (ETRI), Daejeon, South Korea (Feb. 2009, Invited Speaker).
- Montana State University, Bozeman (Oct. 2008, Distinguished Speaker).
- INRIA, Sophia Antipolis (July 2008).

## V. Conference Tutorials

- “Power efficient protocols for mobile ad hoc networks,” *ACM MobiHoc 2004 Conference*, May 2004 (half-day).
- “Power efficient protocols for wireless ad hoc networks,” *ACM MobiCom 2004 Conference*, Sep. 2004 (full-day).

## 10 Professional Service

### ■ Editorial Board

- Editor-in-Chief, *IEEE Transactions on Mobile Computing (TMC)*, Jan. 2017–present.
- Associate Editor, *IEEE Transactions on Cognitive Communications and Networking*, 2015–2018.
- Associate Editor, *IEEE Transactions on Network and Service Management*, 2010–2014.
- Editor, *International Journal of Distributed Sensor Networks*, 2013–2014.
- Member of the International Advisory Committee (IAC), *the Jordanian Journal of Computers and Information Technology (JJCIT)*, 2015–present.
- Associate Editor, *IEEE/ACM Transactions on Networking*, 2001–2008.
- Associate Editor, *IEEE Transactions on Mobile Computing*, 2006–2011.
- Member of the advisory committee of Jordan Journal of Computer and Information Technology, 2015.
- Editor, *Computer Communications Journal*, 2001–2011.
- Technical Editor, *IEEE Communications Interactive Magazine*, 1998–2003.
- Guest Editor (with Ibrahim Matta), *IEEE Communications Magazine, Feature Topic on Quality of Service Routing*, June 2002.
- Guest Editor (with John Lockwood), *IEEE Micro, Special Issue on Hot Interconnects*, Jan./Feb. 2002.

### ■ General Chair, Technical Program Chair, and Steering Committees

- Steering Committee Member (Networking thrust), NSF Research Coordination Network (RCN) on mmWave Wireless Research, June 2016 – present.
- Program Co-organizer and Local Host, 3rd NSF Research Coordination Network (RCN) Workshop on Millimeter-Wave Technologies, Tucson, Jan. 2018.
- Vice General Chair, WiOpt 2016 Conference, Sedona, Arizona, April 2016.
- TPC Chair of Networking Track, IEEE WCNC 2016 Conference, Doha, Qatar, 2016.
- Steering Committee Member, International Symposium on Ubiquitous Networking (UNet), 2016–present.
- Steering Committee Member, International Conference on Communications, Signal Processing, and their Applications (ICCSPA), 2013–present.
- International Advisory Committee Member, Applied Electrical Engineering and Computing Technologies Conference (AEECT), 2013–present.
- General Co-chair, ACM Conference on Wireless Network Security (WiSec), Tucson, April 2012.
- Area TPC Chair, IEEE INFOCOM 2011, Shanghai, China, April 2011.
- Area TPC Chair, IEEE INFOCOM 2010, San Diego, March 2010.
- TPC Chair, IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM 2006), Buffalo, New York, June 2006.
- TPC Chair, IEEE International Conference on Sensor and Ad hoc Communications and Networks (SECON 2005), Santa Clara, Sep. 26-29, 2005.
- TPC Chair, IEEE INFOCOM 2004 Conference, Hong Kong, April 2004.

- TPC Chair, 9th Hot Interconnects Symposium, Stanford University, Aug. 2001.

■ **Executive Committee (other than General/Technical Program Chair):**

- Publicity Co-chair, IEEE INFOCOM 2003, San Francisco, March 2003.
- Publicity Co-chair, ACM MobiCom 2002, Atlanta, Georgia, Sep. 2002.
- Tutorials Co-chair, IEEE INFOCOM 2001 Conference, Anchorage, Alaska, April 2001.
- Panel Chair, IEEE IPCCC 2000 Conference, Phoenix, Arizona, Feb. 2000.
- Panel Co-chair, IEEE INFOCOM '99 Conference, New York, March 1999.

■ **TPC Member**

Served on the TPC for hundreds of international conferences in networking, security, and wireless communications. A subset of these conferences is listed here:

- IEEE INFOCOM Conference: 2016–2013, 2009, 2007–2002, 1998.
- IEEE GLOBECOM 2015 Conference.
- IEEE Conference on Communications and Network Security (CNS), Florence, Italy, Sep. 2015.
- ACM Workshop on Cognitive Radio Architectures for Broadband (CRAB): 2013, 2014.
- 1st IEEE International Workshop on Cognitive Cellular Systems (CCS), Germany, Sep. 2014.
- IEEE International Workshop on Network Science for Communication Networks (NetSciCom 2013), Torino, Italy, April 2013.
- European Wireless 2010 Conference (EW '2010), Lucca, Italy, April 2010.
- IEEE ICNP Conference, 2009.
- IEEE MASS, Macau SAR, China, October 5–9, 2009.
- 4th International Conference on Innovations in Information Technology (IIT2007) – Information Communication Technologies track, Dubai, UAE, November 18–20, 2007.
- ACM MobiHoc Conference: 2007, 2006, 2005.
- CrownCom 2007 (Second International Conference on Cognitive Radio Oriented Wireless Networks and Communications), Orlando, Florida, Aug. 1–3, 2007.
- International Workshop on Theoretical and Algorithmic Aspects of Sensor and Ad-hoc Networks (WTASA '07), Miami, Florida, June 28–29, 2007.
- IASTED International Conference on Modern Nonlinear Theory – Bifurcation and Chaos (MNT 2007), Montreal, Canada, May 30 – June 1, 2007.
- Global Information Infrastructure Symposium (GIIS '07), Marrakech, Morocco, July 2–5, 2007.
- WiOpt '06 (4th International Symposium on Modeling and Optimization in Mobile Ad-hoc and Wireless Networks), April 2006, Boston, Massachusetts.
- IEEE International Performance Computing and Communications Conference (IPCCC): 2006, 2003.
- Jordanian International Electrical and Electronic Engineering Conference (JIEEEEC), 2005.
- Third International Workshop on Measurement, Modeling, and Performance Analysis of Wireless Sensor Networks (SenMetrics 2005), San Diego, CA, July 21, 2005.
- Multimedia Service Access Networks (MSAN) Conference, Orlando, Florida, June 2005.
- IEEE Conference on Sensors and Ad Hoc Communications and Networks (SECON): 2005, 2004.

- IEEE International Conference on Mobile Ad-hoc and Sensor Systems (MASS), 2004.
- Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net 2004), Bodrum, Turkey, June 2004.
- 4th Workshop on Applications and Services in Wireless Networks (ASWN 2004), Boston, Massachusetts, August 2004.
- ACM SIGMETRICS 2003 Conference, San Diego, June 2003.
- IEEE ICC 2003 Conference, Anchorage Alaska, May 2003.
- IEEE Workshop on Aspect Oriented Programming for Distributed Computing Systems (part of ICDCS 2002), July 2002.
- The 1st International Workshop on Wired/Wireless Internet Communications (WWIC 2002), Las Vegas, June 2002.
- Annual Simulation Symposium (ANSS): 2002 and 2001.
- IEEE International Conference on Computer Communications and Networks (ICCCN 2001), Scottsdale, Arizona, Oct. 2001.
- International Teletraffic Congress (ITC 2001), Salvador, Brazil, Sep. 2001.
- IEEE International Conference on Multimedia and Expo (ICME): 2000 and 2001.
- Quality of Service over Next Generation Data Networks Conference (part of the SPIE ITCOM Symposium), Denver, Colorado, August 2001.
- International Workshop on Distributed Dynamic Multiservice Architectures (sponsored by IEEE Computer Society), Phoenix, Arizona, April 2001.
- IEEE GLOBECOM 2000, San Francisco, Dec. 2000.
- IEEE GLOBECOM Symposium on High Speed Networks: 1999, 2000.
- IEEE ICDCS '2000 Conference, April 2000.
- IEEE Multimedia Systems '99 Conference, Florence, Italy, June 1999.
- Internet Workshop '99, Japan.
- SPIE Performance and Control of Network Systems Conference, Nov. 1997.

■ **Session Chair**

- IEEE INFOCOM 2014 Conference, April 2014.
- IEEE Computer Communications Workshop (CCW'12), Sedona, AZ, Nov. 2012.
- IFIP Networking 2011, Valencia, Spain, May 2011.
- IEEE INFOCOM 2010, San Diego, CA, March 2010.
- IEEE INFOCOM 2006, Barcelona, Spain, April 2006 (session 9: Smart Antennas and MAC).
- IEEE INFOCOM 2006, Barcelona, Spain, April 2006 (session 53: Wireless Power).
- ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc 2005), Urbana-Champaign, IL, May 2005.
- IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM 2005), Sicily, Italy, June 2005.
- IEEE Computer Communications Workshop (CCW) 2001, Oct. 2001.
- ACM SIGMETRICS 2000, Santa Clara, June 2000.

- IEEE GLOBECOM 2000, San Francisco, Dec. 2000.
- IEEE GLOBECOM '99 – Symposium on High Speed Networks.
- IEEE INFOCOM '99 Conference, New York, March 1999.
- IEEE ATM workshop, Aug 1996.
- SPIE Performance and Control of Network Systems Conference, Nov. 1997.

■ **Session Organizer**

- IEEE Computer Communications Workshop (CCW'12), Sedona, AZ, Nov. 2012.
- International Conference on Computer Communications and Networks (ICCCN'04), Chicago, Oct. 2004.
- IEEE Computer Communications Workshop (CCW) 2001, Oct. 2001.
- IEEE GLOBECOM 2000, San Francisco, Dec. 2000.
- SPIE Performance and Control of Network Systems Conference, Nov. 1997.

■ **Reviewer and Panelist for Research Funding Agencies**

- National Science Foundation: CNS/NeTS (2015), EARS (2012), NetSE/Medium (2009), CAREER (2001, 2003, 2006), ECS/Integrative Systems Program (2005), etc.
- Army Research Office (ARO).
- King Abdulaziz City for Science and Technology (KACST) - Strategic Technologies Program (multiple times, coordinated through AAAS).
- King Abdulaziz University for Science and Technology (KAUST) – Competitive Research Grants (CRG) program (2017).
- Kansas Experimental Program to Stimulate Competitive Research (coordinated through AAAS).
- Science Foundation Ireland (SFI) - multiple times.

■ **Other Significant Professional Service**

- Member of the IEEE Computer Society Fellows Evaluation Committee (2015).
- Member of the IEEE Communications Society Outstanding Service Award Committee (2014).
- Representative of the IEEE Technical Committee on Computer Communications (TCCC) for GLOBECOM 2000 Conference.
- Session Organizer and Chair, 2nd NSF PI meeting, Irvine, Nov. 2000.

■ Reviewer for several journals and conferences.



## Department, College, and University Service

- Five-year Review Committee for the UA's Dean of Engineering (2015/2016).
- ECE Faculty Search Committees: 2014/2015 (3 faculty hires), 2012/2013 (3 faculty lines), 2006/2007 (committee chair, four faculty lines), 2001/2002 (one faculty line), 1999/2000 (committee chair, one faculty line).
- Department Peer-review Committee (2014, committee chair).
- Faculty Status Committee (department-level P&T committee): 2007–2010, 2012–2016, and 2017–present (served 9 years, chairing the committee three times). Committee work includes soliciting letters from external reviewers, evaluating candidates for tenure and promotion as well as 3-year renewal; and making written recommendations to the department head.
- Revised Workload Guidelines and Salary Recovery Committee (2015; ad hoc committee that drafted the revised departmental workload guidelines).
- ECE Department Head Search Committee (2011).
- Search Committee for an Assistant Dean for Finance and Administration in the College of Engineering (2011).
- Department Executive Committee (2014/2015 and 2015/2016).
- UA Faculty Senate – College of Engineering representative (2010–2012).
- ECE Department Peer-review Committee (2011 and 2012).
- University's Committee on Academic Freedom and Tenure (2008–2011)
- Chair, Computer Engineering Group, ECE Department (2006–2008).
- Graduate Studies Committee (1998–2000 and 2004–2006).
- Ad Hoc Committee for Revising the ECE Workload Guidelines (2004/2005).
- University Graduate Council (2003–2007).
- Prop. 301 ECE Ad Hoc Committee (Spring and Fall 2002).
- Undergraduate Studies Committee (2001/2002).
- Ad hoc Committee for Evaluating the Teaching Load (2000/2001).
- Computer Engineering Curriculum Committee (1999/2000 and 2000/2001).
- Computer Policy Committee (1998/1999, 1999/2000, 2008/2009).
- Undergraduate Student Recruitment Committee (1997).
- Scientific Integrity Oversight Member of the Oversight Committee for Prof. Christopher Walker, Dept. of Astronomy (2017-2018).

## Postdoctoral Mentoring and Graduate Student Advising

### I. Mentored Research Scientists and Postdoctoral Researchers (past and present)

- Mingjie Feng (postdoc, Sep. 2018 – present)
- Yong Xiao (assistant research professor, Sep. 2016 – Aug. 2018)  
Current Position: Professor, School of Electronic Information and Communications, Huazhong University of Science & Technology, China.
- Manjesh Hanawal (postdoc, April 2013 – Dec. 2013)  
Current Position: Assistant Professor, Industrial Engineering and Operations Research Dept., IIT-Bombay, India.
- Diep Nguyen (postdoc, May 2013 – Oct. 2013)  
Current Position: Senior Lecturer, School of Computing and Communications, University Technology of Sydney, Australia.
- Ossama Younis (postdoc and research assistant professor, 2005–2007)  
Current Position: Research Scientist, Advanced Network Technologies Division (ANTD), National Institute of Standards & Technology (NIST), Washington DC.
- Tao Shu (postdoc, 2004–2006)  
Current Position: Assistant Professor in Computer Science, Auburn University, Alabama.

### II. Supervised Ph.D. Dissertations

Supervised to completion 16 Ph.D. dissertations:

1. Wessam Affi, Ph.D. in Dec. 2016 (currently a Senior Research and Development Engineer, Mavenir Systems).  
*Dissertation title:* Inband Full-duplex Wireless Communications for Dynamic Spectrum Sharing Systems.
2. Hanif Rahbari, Ph.D. in May 2016 (currently an assistant professor at Rochester Institute of Technology).  
*Dissertation title:* Obfuscation of Transmission Fingerprints for Secure Wireless Communications.
3. Mohammad Jamal Abdel-Rahman, Ph.D. in December 2014 (currently a postdoctoral research associate at Virginia Tech.).  
*Dissertation title:* Robust Cognitive Algorithms for Fast-varying Spectrum-agile Wireless Networks.
4. Diep Nguyen, Ph.D. in April 2013 (currently a Senior Lecturer, University of Technology Sydney, Australia).  
*Dissertation title:* Resource Allocation Strategies for Cognitive and Cooperative MIMO Communications: Algorithms and Protocol Design.
5. Sisi Liu, Ph.D. in Dec. 2011 (currently a Member of Technical Staff, Broadcom Corporation).  
*Dissertation title:* Securing Wireless Broadcast Communication against Internal Attacks (co-advised with Prof. Loukas Lazos).

6. Tao Shu, Ph.D. in Dec. 2010 (currently an Assistant Professor in the Department of Computer Science at Auburn University, Alabama).  
*Dissertation title:* Efficient Radio Resource Management and Routing Mechanisms For Opportunistic Spectrum Access Networks.
7. Raed Al-Zubi, Ph.D. in August 2010 (currently an Assistant Professor at the University of Jordan, Amman, Jordan).  
*Dissertation title:* Mechanisms and Protocols for Interference Management and Resource Utilization in UWB Networks.
8. Fan Wang, Ph.D. in August 2009 (currently a senior manager of the Smart Machine team at Samsung Research, San Jose).  
*Dissertation title:* Utility-based resource allocation strategies and protocol design for spectrum-adaptive wireless networks.
9. Mohammad Siam, Ph.D. in April 2009 (currently an Associate Professor at Al-Isra University, Amman, Jordan).  
*Dissertation title:* Power-controlled channel access and routing protocols for MIMO-capable wireless networks.
10. Haythem Bany Salameh, Ph.D. in April 2009 (currently a professor of telecommunications at Yarmouk University, Jordan).  
*Dissertation title:* Channel access mechanisms and protocols for opportunistic cognitive radio networks.
11. Satyajeet Ahuja, Ph.D. in Aug. 2008 (currently with Facebook, CA).  
*Dissertation title:* Algorithmic solutions for constrained path selection and monitoring in wired and wireless networks.
12. Mohamed Hassan, Ph.D. in November 2005 (currently a professor of electrical engineering at the American University of Sharjah, United Arab Emirates).  
*Dissertation title:* Adaptive techniques and optimizations for media streaming over wireless channels.
13. Alaa Muqattash, Ph.D. in November 2005 (currently Founder and General Manager of Advanced Business Solutions, a regional IT company specialized in delivering business software solutions to the MENA market).  
*Dissertation title:* Medium access control and adaptive transmission techniques in wireless networks.
14. Abdullah Balamash, Ph.D. in Aug. 2004 (currently an Associate Professor in ECE at King Abdulaziz University, Saudi Arabia).  
*Dissertation title:* Web traffic modeling and its application in the design of caching and prefetching systems.
15. Turgay Korkmaz, Ph.D. in Oct. 2001 (currently an Associate Professor at the University of Texas – San Antonio).  
*Dissertation title:* QoS routing in packet networks.
16. Jeong Geun Kim, Ph.D. degree in March 2000 (currently an Associate Professor in Radio Communication Engineering at Kyunghee University, Korea).  
*Dissertation title:* Providing quality-of-service guarantees in multi-service wireless networks.

### III. Supervised M.S. Theses

Supervised to completion 9 M.S. theses.

1. Harish Kumar Shankar, M.S. degree in April 2013 (currently a Software Engineer at Palo Alto Networks, Santa Clara, CA).  
*Thesis title:* Cooperative QoS-aware sensing/probing architecture and cross-layer protocol design for multi-rate opportunistic networks
2. Amit Kumar, M.S. degree in Dec. 2008.  
*Thesis title:* Modeling the short-term characteristics of Internet traffic at boundary routers.
3. Aman Arora, M.S. degree in May 2004 (currently Sr. Staff Engineer/Manager at Qualcomm).  
*Thesis title:* Interference-limited concurrent transmissions for wireless ad hoc networks with directional antennas.
4. Vignesh Bhvaneshwar, M.S. in Dec. 2003 (currently at Qualcomm Inc., San Diego).  
*Thesis title:* A cross-layer power aware protocol for wireless ad hoc networks.
5. Aytac Azgin, M.S. in Dec. 2003.  
*Thesis title:* Scheduling in wireless cellular networks under probabilistic channel information.
6. Michelle D'Souza, M.S. in April 2003 (currently at Mouser Electronics, Texas).  
*Thesis title:* Evaluating the performance of TCP over wireless links.
7. Alaa Muqattash, M.S. degree in Dec. 2002 ((currently a Member of Technical Staff at Olympus Communication Technology of America, San Diego, California).  
*Thesis title:* Transmission power control for wireless ad hoc networks.
8. Lifeng Zhang, M.S. in August 1999 (currently at ILS International Library Systems).  
*Thesis title:* Using  $M/G/\infty$  processes for modeling MPEG-compressed video traffic.
9. Arivu Ramasamy, M.S. in June 1999 (currently at Cisco Systems, Inc.).  
*Thesis title:* WWW traffic characterization and its application in dimensioning network resources.