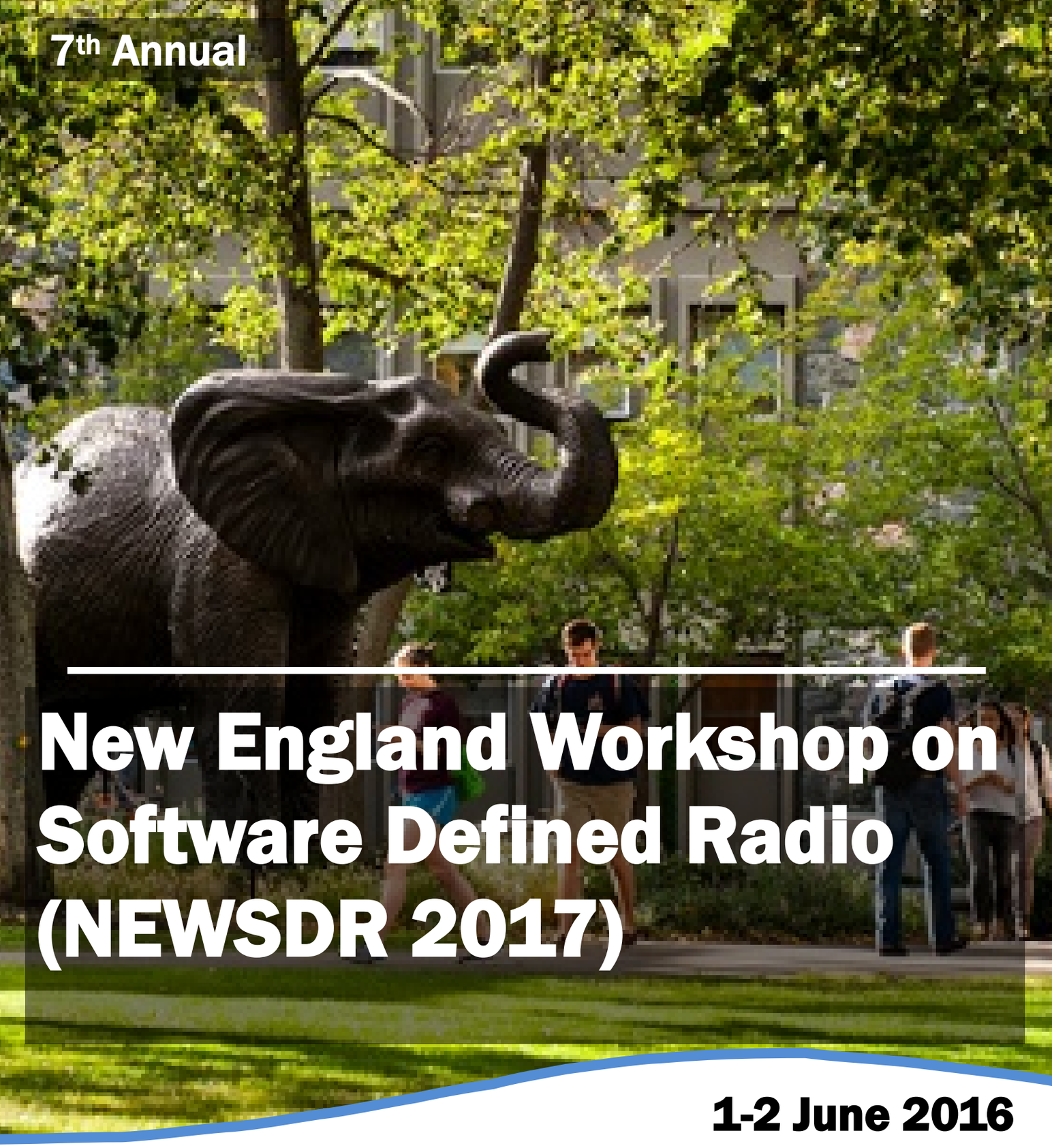

7th Annual

New England Workshop on Software Defined Radio (NEWSDR 2017)

1-2 June 2016

Tufts University | Medford, Mass

Sponsored By:

MathWorks

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SDR-Boston
Boston SDR User Group

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Welcome

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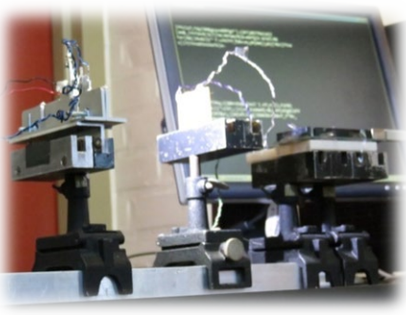

The 2017 New England Workshop on Software Defined Radio (NEWSDR) is the seventh exciting installment of an annual series of workshops organized by the Boston SDR User Group (SDR-Boston). This year, we are very excited about having Tufts University generously serve as the host institution for NEWSDR 2017!

The goal of this series of workshops is to provide a forum through which individuals working on SDR-related projects in the New England area can get together in order to collaborate and introduce SDR concepts to those interested in furthering their knowledge of SDR capabilities and available resources.

Following on the success of these workshops, this year's NEWSDR event offers a chance for presenting the latest developments in SDR and Cognitive Radio research by individuals from academia, industry, and government in the New England area, as well as from across the Nation. In addition to providing an opportunity for researchers in this area to network and interact on issues relating to SDR and Cognitive Radios, NEWSDR 2017 will include:

- Keynote Presentations on the latest in SDR
- Poster Presentations with Short "Elevator-Pitch" Oral Presentations
- Technology demonstrations
- Hands-On Tutorials
- Breakfast / coffee / lunch included with advanced registration

During this event, we would like to encourage all of you to engage in conversation with your fellow attendees, exchange ideas, and talk about your latest findings with respect to SDR. We hope that you will find NEWSDR 2017 a productive event to expand your knowledge and horizons regarding SDR technology, and we would like to wish you a very positive and rewarding workshop!

Agenda – 2 June 2016

8:00AM-8:15AM	**Welcome and Introduction**
8:15AM-9:40AM	**Sponsor Flash Talks (20 minutes each)**
9:40AM-10:15AM	**"Elevator Pitch" Oral Presentations of Poster Presenters (2 minutes each)**
10:15AM-10:45AM	**Coffee, Networking Break, Poster Presentations, Sponsor Exhibits and Demos**
10:45AM-11:45PM	**Industry Tutorial Presentation #1:** "Fixing the Broken Telephone – A Case for Channel Coding in 5G" — MediaTek
11:45AM-1:00PM	**Lunch and Networking**
1:00PM-2:00PM	**Keynote Presentation: "SDR Opportunities and Challenges Thru a Major Period of Transition"** *Professor Dennis Roberson, Illinois Institute of Technology*
2:00PM-2:30PM	**Coffee, Networking Break, Poster Presentations, Sponsor Exhibits and Demos**
2:30PM-3:30PM	**Industry Tutorial Presentation #2:** "An Introduction to the Analog Devices PlutoSDR" — Analog Devices, Mathworks
3:30PM-4:00PM	**Closing Remarks and Adjournment**

Keynote Speaker

Dennis Roberson has been Vice Provost and Research Professor with the Illinois Institute of Technology (IIT) since June 2003, where he established a new undergraduate business school, a wireless research center (WiNCom), IIT's corporate relations initiative, and is currently responsible the latter two efforts and IIT's Research efforts, strategic plan assessment, and its technology commercialization office and externally focused entrepreneurial efforts. Professor Roberson is also President, CEO and Member of Roberson and Associates, LLC, a technology and management consulting firm serving a variety of government and commercial customers since 2008. From April 1998 to April 2004, Professor Roberson was Executive Vice President and Chief Technical Officer of Motorola, Inc. From 1971 to 1998, he held senior executive positions with NCR Corporation, AT&T, Digital Equipment Corp. (now part of Hewlett Packard) and IBM. Professor Roberson is a Director of Advanced Diamond Technologies, Cleversafe, Caerus Institute, OnKol and SonSet Solutions. He also chairs the U.S. Federal Communication Commission's Technology Advisory Council and serves on the U.S. Commerce Department's Commerce Spectrum Management Advisory Committee (CSMAC). He has served as an invited expert for the development of the PCAST Spectrum Policy Report, the Board of Directors of FIRST Robotics, the National Advisory Council for the Boy Scouts of America, the Board of Singapore's Agency for Science, Technology and Research, and as an International Advisory Panel member for the Prime Minister of Malaysia. He holds Bachelor of Science Degrees in Physics and Electrical Engineering from Washington State University and a Master of Science in Electrical Engineering from Stanford University.

Hands-On SDR Experimentation & Short Courses

SDR with E310 using Simulink

MathWorks

This tutorial focuses on demonstrating modeling Software Defined Radio-based designs in MATLAB and Simulink® and configuring and deploying on the E310. Topics presented will include modeling communication systems using Simulink, implementing radio I/O with E310 and Simulink, and prototyping deployment with real-time data via HW/SW co-design.

Prior knowledge of programming Xilinx Zynq SoCs with MATLAB and Simulink, and knowledge of communications systems and hardware design are prerequisites.

Outline:

- Model Communication system using Simulink
  - Model and simulate RF signal chain and communication algorithms
    - Overview of Software Defined Radio concepts and workflows.
    - Simulate a communication system that includes a transmitter, AD9361 transceiver, channel, and receiver (RF test environment).
- Implement Radio I/O with E310 SDR and Simulink
  - Verify the operation of baseband transceiver algorithm using real data streamed from the AD9361 into MATLAB and Simulink.
    - Overview of System objects and hardware platforms
    - Perform baseband processing in MATLAB and Simulink on received signal
    - Verify algorithm performance for real data versus simulated data.
- Hardware-Software Co-Design for Software
  - Split and deploy Tx/Rx algorithms to PL and PS
    - Overview of Zynq HW/SW co-design workflow
    - Implement transmitter and receiver on PL/PS using HW/SW co-design workflow
    - Download generated code to the ARM & FPGA, and tune system parameters in real-time operation via Simulink

FPGA Programming on the USRP with the RFNoC Framework

Ettus Research/National Instruments

Ettus Research's RFNoC (RF Network-on-Chip) software is meant to decrease the development time for experienced FPGA engineers seeking to integrate IP into the USRP signal processing chain. RFNoC is the architecture for USRP devices that use Xilinx 7-series FPGAs (E310, E312, X300, X310). RFNoC is built around a packetized network infrastructure in the FPGA that handles the transport of control and sample data between the host CPU and the radio. Users target their custom algorithms to the FPGA in the form of Computation Engines (CE), which are processing blocks that attach to this network. CEs act as independent nodes on the network that can receive and transmit data to any other node (e.g., another CE, the radio block, or the host CPU). Users can create modular, FPGA-accelerated SDR applications by chaining CEs into a flow graph. RFNoC is supported in UHD and GNU Radio. In this workshop, we will present an interactive hands-on tutorial on RFNoC, including a discussion on its design and capabilities, demonstrations of several existing examples, and a walk-through on implementing a user-defined CE and integrating the CE into GNU Radio.

Prerequisites:

- Attendees are expected to bring their own laptops to the workshop. The laptop should have a minimum of 4 GB memory, 60 GB of free disk space, one Ethernet port available, and one USB 3.0 port available.
- Attendees are expected to install VirtualBox 5.1.18 or newer.

All necessary USRP hardware will be provided in the workshop. Attendees do not need to bring any USRP hardware.

Fixing the Broken Telephone – A Case for Channel Coding in 5G

MediaTek

In this presentation we provide an overview into the current standardization effort for 5G with a specific focus on the high profile area of channel coding selection. We start with an overview of what 5G is and where it comes from. We then take a shallow dive into channel coding, relating it to real world examples you may not have considered as forms of coding, before moving to some details of the current Low Density Parity Check (LDPC) proposals. Lastly we present how 3GPP works to standardize 5G and what the current status is for the topic of channel coding/multiplexing.

Presenter: Timothy Fisher-Jeffes

An Introduction to the Analog Devices PlutoSDR

Analog Devices, Mathworks

In this short course, we will present an overview of the PlutoSDR radio by Analog Devices, including its I/O characteristics, as well as its onboard ARM processor and FPGA. Several demonstrations will be provided, including ARM targeting of an FM radio transmitter. Furthermore, Mathworks tools (MATLAB, Simulink) for designing radio systems using the PlutoSDR will be presented, including system objects. ARM and HDL targeting will also be discussed, as well as future plans for using Codegen planned for future. Demonstrations using Mathworks tools and the PlutoSDR include WLAN image transmission and transmit repeat.

Poster Presentations

Bumblebee-Inspired Vehicular Communications

Bengi Aygun (WPI), Rob Gegear (WPI), Liz Ryder (WPI), Alex Wyglinski (WPI)

We present dynamic spectrum access mechanism for vehicle-to-vehicle communications inspired by the optimal flower selection process employed by foraging bumblebees. The proposed interdisciplinary solution of translating bumblebee learning, memory, and decision-making processes into a highly time varying connected vehicle framework. Different memory lengths and scheme are implemented to IEEE 802.11p standard. The proposed approach will be implemented on USRP N210 radios. This work is sponsored by the US National Science Foundation. For more information about this and other research activities conducted at WPI's Wireless Innovation Laboratory, please visit http://www.Wireless.WPI.edu.

MATLAB Multicore DataFlow

Travis Collins (WPI), Alex Wyglinski (WPI)

In this poster we present a DataFlow architecture for MATLAB. Providing thread level pipelining of MATLAB functions as well as general concurrency. Resulting in significant speedup of current MATLAB based SDR implementations on multicore systems. Demonstrated by a 20x speed increase for a 802.11a receiver, running in real-time. This work is sponsored by the Mathworks. For more information about this and other research activities conducted at WPI's Wireless Innovation Laboratory, please visit http://www.Wireless.WPI.edu.

NEWSDR 2017 was made possible by generous contributions from our sponsors.

MathWorks is the leading developer of mathematical computing software. Engineers and scientists worldwide rely on its products to accelerate the pace of discovery, innovation, and development.

Since 1976, National Instruments has equipped engineers and scientists with tools that accelerate productivity, innovation, and discovery. NI's graphical system design approach provides an integrated software and hardware platform that simplifies development of any system that needs measurement and control. Engineers and scientists use this platform from design to production in multiple industries, advanced research, and academia. The company's long-term vision and focus on improving society through its technology has led to strong, consistent company growth and success of its customers, employees, suppliers, and shareholders.

Ettus Research™, a National Instruments (NI) company since 2010, is the world's leading supplier of software defined radio platforms, including the Universal Software Radio Peripheral (USRP™) family of products. With a low overall system price, expansive capabilities, and software availability, USRP products are used by thousands of engineers worldwide and remain the top choice in software defined radio hardware for algorithm development, exploration, and prototyping.

MediaTek is a pioneering fabless semiconductor company, and a market leader in cutting-edge systems on a chip for wireless communications, HDTV, DVD and Blu-ray. MediaTek created the world's first octa-core smartphone platform with LTE and our CorePilot technology released the full power of multi-core mobile processors. MediaTek [TSE:2454] is headquartered in Taiwan and has offices worldwide.

Analog Devices is a world leader in the design, manufacture, and marketing of a broad portfolio of high performance analog, mixed-signal, and digital signal processing (DSP) integrated circuits (ICs) used in virtually all types of electronic equipment. Used by over 60,000 customers worldwide, our signal processing products play a fundamental role in converting, conditioning, and processing real-world phenomena such as temperature, pressure, sound, light, speed, and motion into electrical signals to be used in a wide array of electronic devices.

A community within the New England area that possesses members from academia, industry, and government who are involved in the design and implementation of software-defined radio (SDR) technology in order to advance the current state-of-the-art in wireless communication systems and networks.