



**VTC2015-Spring**  
**GLASGOW**  
*Innovating a Connected World*



Thursday 14 May 2015 — Industrial Design Day  
University of Strathclyde • Glasgow, Scotland



## Rapid Prototyping of Real-Time Wireless Systems with NI LabVIEW Communications System Design Suite

13:30—17:00 Conference Room 3

**Sanjay Challa**

*Product Manager for Embedded Software at National Instruments*

*Sanjay Challa is one of the product managers for embedded software at National Instruments (NI), who is focused on real-time operating systems and FPGA-based embedded systems. He joined NI in 2010 as a member of the Application Engineering department. Sanjay transitioned into his current role late in 2011, and has since driven the strategy and messaging around security, configuration management, and deployment of NI's embedded hardware systems, and the NI Linux Real-Time OS. Sanjay received his bachelor's degree in Biomedical Engineering from the Georgia Institute of Technology.*

*Summary—In today's competitive wireless research space, the ability to prototype ideas quickly on hardware using real signals is more important than ever. Attendees will gain hands-on experience with National Instruments' integrated hardware and software platform for rapid prototyping of real-time wireless systems using the NI LabVIEW Communications System Design Suite (LabVIEW Communications) and the NI USRP RIO FPGA-based software defined radio. The final result will be the attendee's ability to design, simulate, and prototype a 5-MHz LTE-based real-time OFDM link on a high performance FPGA, and transmit data over the air using the link designed on the NI USRP RIO. This industrial design workshop will cover the most important aspects of the idea-to-prototype flow in a single tool, including floating-point simulation, floating-point to fixed-point conversion, HW/SW partitioning, performance-complexity tradeoffs, and finally verification and testing on an FPGA-based software-defined radio.*

*Note: No prior experience with FPGA's or NI hardware or software tools is required.*

### Objectives

In this half-day workshop, attendees will gain **hands-on experience** with **National Instruments'** integrated hardware and software platform for rapid prototyping of real-time wireless systems. The NI LabVIEW Communications System Design Suite (LabVIEW Communications) and the NI USRP RIO FPGA-based software defined radio will be used. At the end of the session, attendees will be able to design, simulate, and prototype a 5 MHz LTE-based real-time OFDM link on a high performance FPGA, and transmit data over the air using the link designed on the NI USRP RIO.

### Presentation Topics

This session gives an overview of NI LabVIEW Communications System Design Suite & NI USRP RIO:

1. System Architecture Definition
  - a. System Designer Tool
  - b. Reference Designs and Sample Projects
2. Initial Floating Point Algorithm Development
  - a. MathScript and C Nodes
  - b. Multi-Rate Diagram
  - c. Unit Testing
3. Preparing a Design for Deployment to FPGA
  - a. Fixed Point Conversion
  - b. System Testbenches
  - c. FPGA Simulation
  - d. FPGA Compile
4. Connecting and Exercising your Design Over The Air
  - a. Integrating the design into an existing Sample Project
  - b. Data communication to/from the FPGA