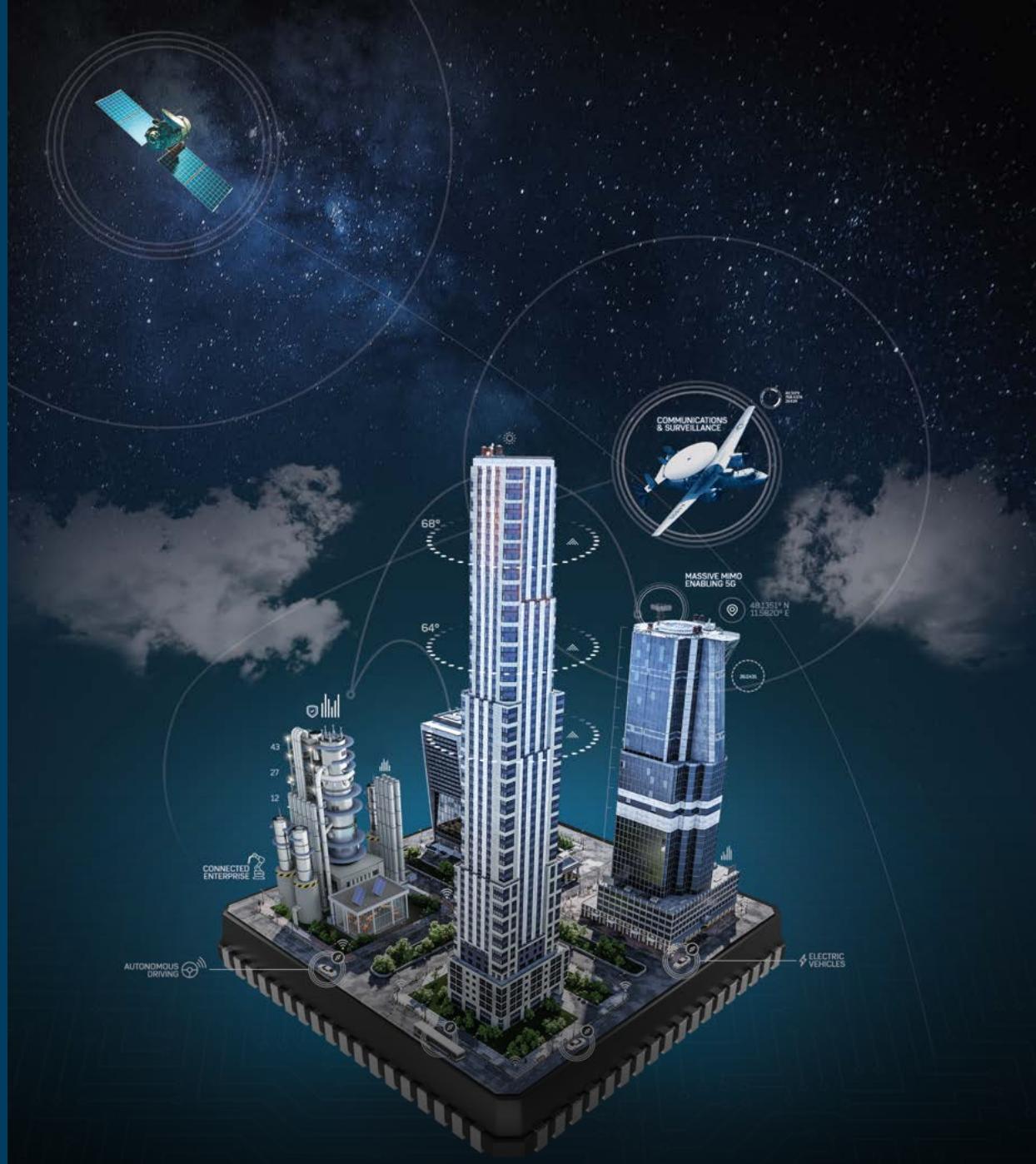




AHEAD OF WHAT'S POSSIBLE™

Analog Devices Company Introduction



Analog Devices At A Glance

Founded **1965**

Headquarters **Norwood, MA**

Employees **~15,000**

Countries **20+**

Products **~45,000 SKUs**

Customers **125,000**

Publicly Listed
NASDAQ:ADI
Part of S&P 500 and NASDAQ 100

Design Centers **~45**



What We Do

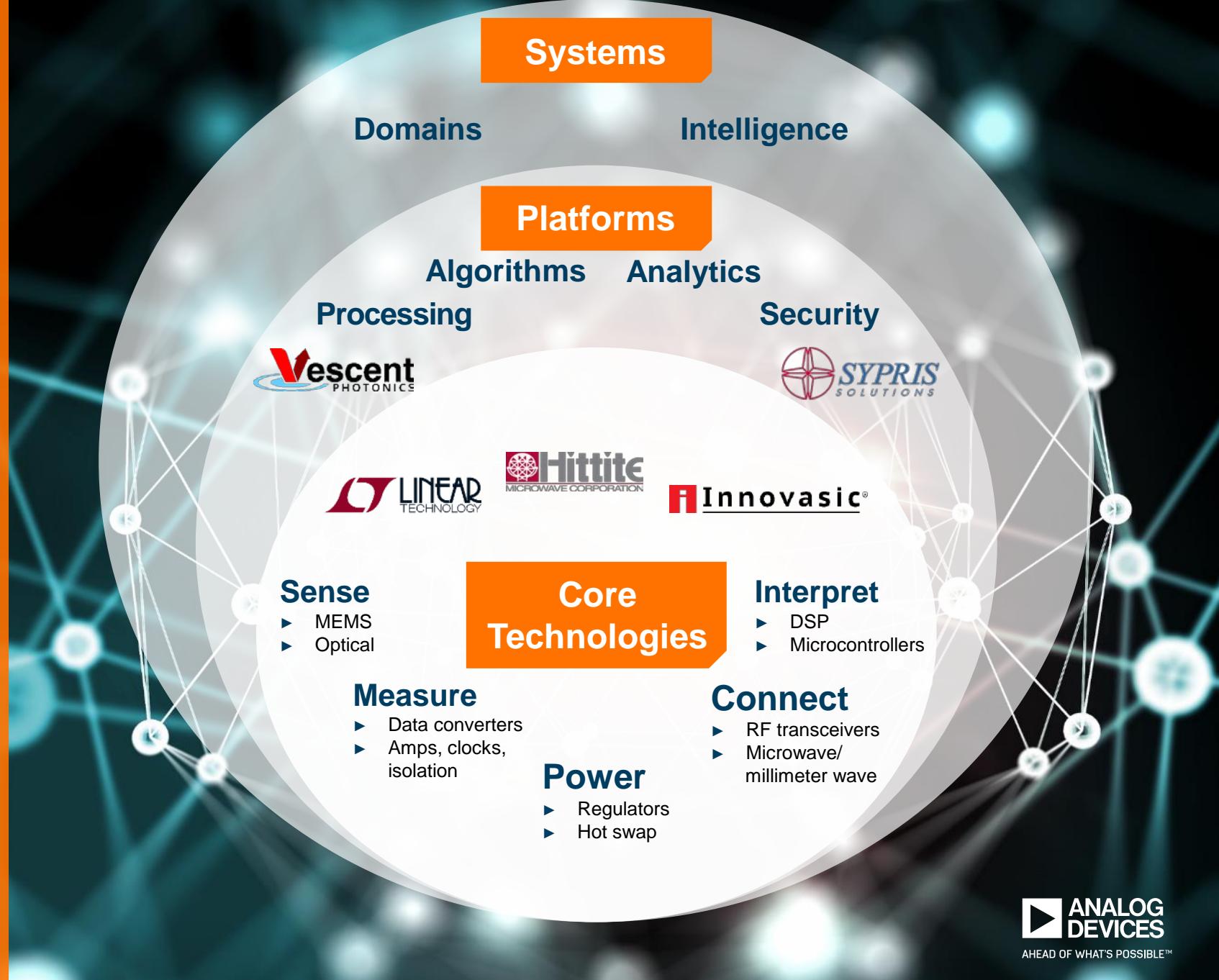
- ▶ Design, manufacture, and market a broad portfolio of solutions that leverage high performance analog, mixed-signal, and digital signal processing technology, including integrated circuits (ICs), algorithms, software, and subsystems.



What We Deliver

- ▶ Solutions that sense, measure, power, connect, and interpret the world around us.

OUR CUSTOMERS
GAIN VALUE
THROUGH
ANALOG DEVICES'
PERFORMANCE
TECHNOLOGY AND
EXPERTISE,
STRATEGIC
ACQUISITIONS,
AND ADVANCEMENT
FROM SILICON TO
SOFTWARE TO CLOUD



DELIVERING INNOVATION THAT KEEPS OUR CUSTOMERS AHEAD OF WHAT'S POSSIBLE

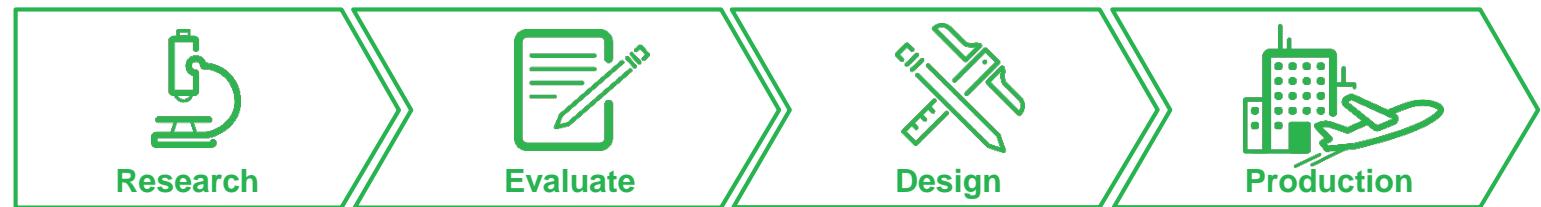


Design and Support Resources

Accelerate Our Customer's Journey
from Research to Production



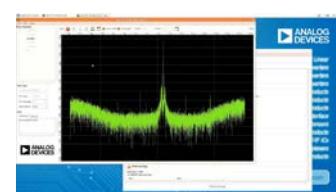
- ▶ Connecting the stages and driving consistency across the customer design journey with software, tools, models, and hardware.



- ▶ Education and selection tools for matching ideas to solutions
- ▶ Online behavioral models to test concepts quickly



- ▶ Common evaluation hardware and software
- ▶ Evaluation platforms and development platforms



- ▶ Online and downloadable design tools
- ▶ Adoption of industry standards, such as Arduino, for ease of prototyping and reference designs



LTspice Simulation

- ▶ Online customer support
- ▶ Communities
- ▶ Forums
- ▶ Wikis



EngineerZone®
support community



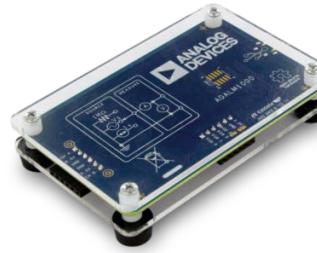
Inspiring Future Engineers and Innovators

► Active Learning Program:

- dedicated to inspiring students to better understand analog real world signals
- Enables integration of technology into course curricula, design and research projects



Tools for teaching and learning about circuits

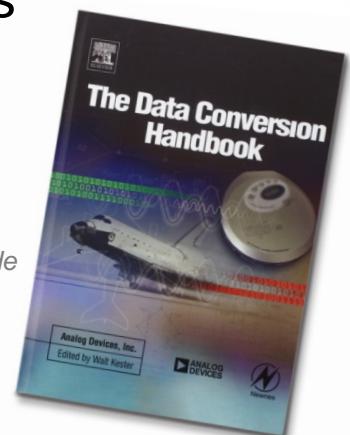


Analog Parts Kit

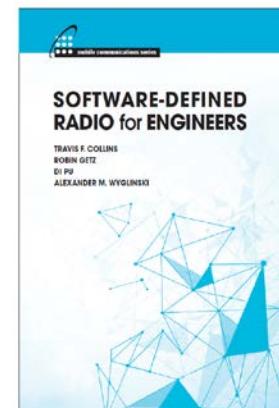
► Support STEM initiatives including FIRST Robotics



► Recruit the best and brightest minds



Data Conversion Handbook
Required Reading by EE's Worldwide

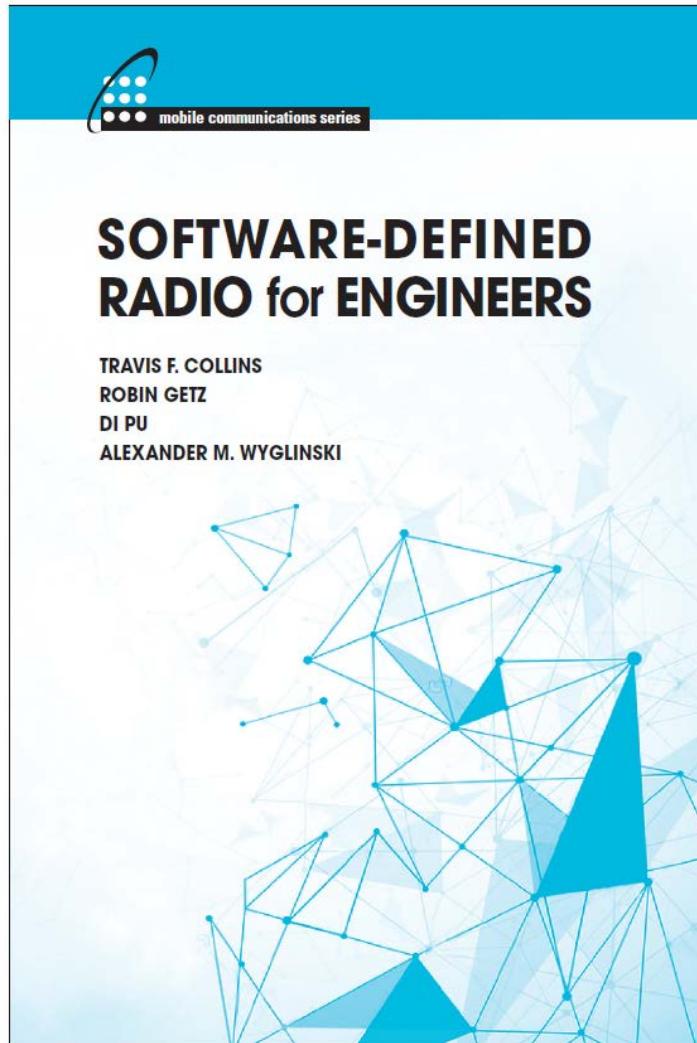


Tools for teaching and learning about communications

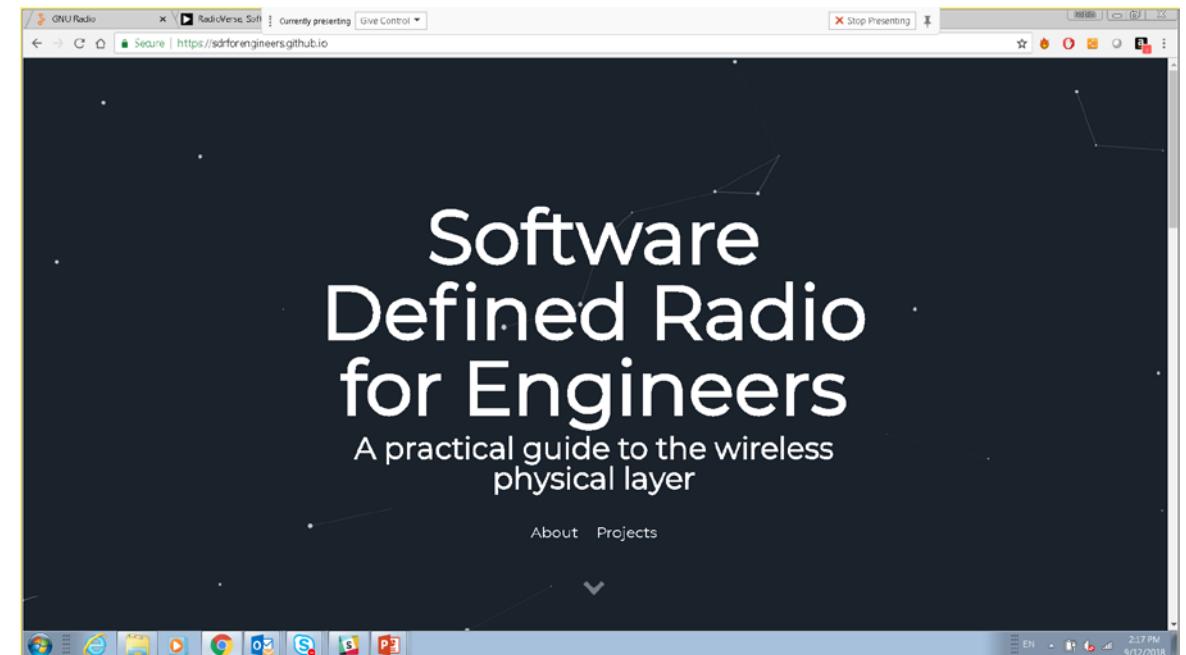


The most important thing in education : TextBooks and Labs

- ▶ Dr. Travis Collins
- ▶ Robin Getz
- ▶ Dr. Alex Wyglinski
- ▶ Dr. Di Pu

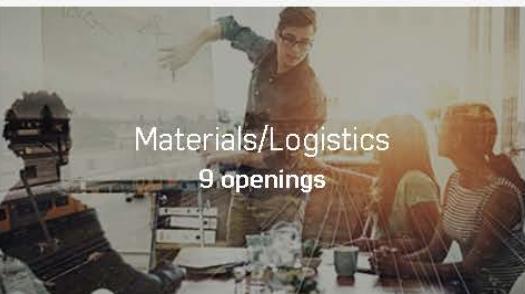


▶ <http://sdrforengineers.com>



- United States (145)
- Ireland (33)
- Philippines (30)
- India (26)
- China (16)
- Germany (6)
- Malaysia (6)
- Japan (4)
- Singapore (3)
- Canada (2)
- Taiwan (2)
- Netherlands (1)
- Romania (1)
- Spain (1)

HOW DO YOU WANT TO CONTRIBUTE?





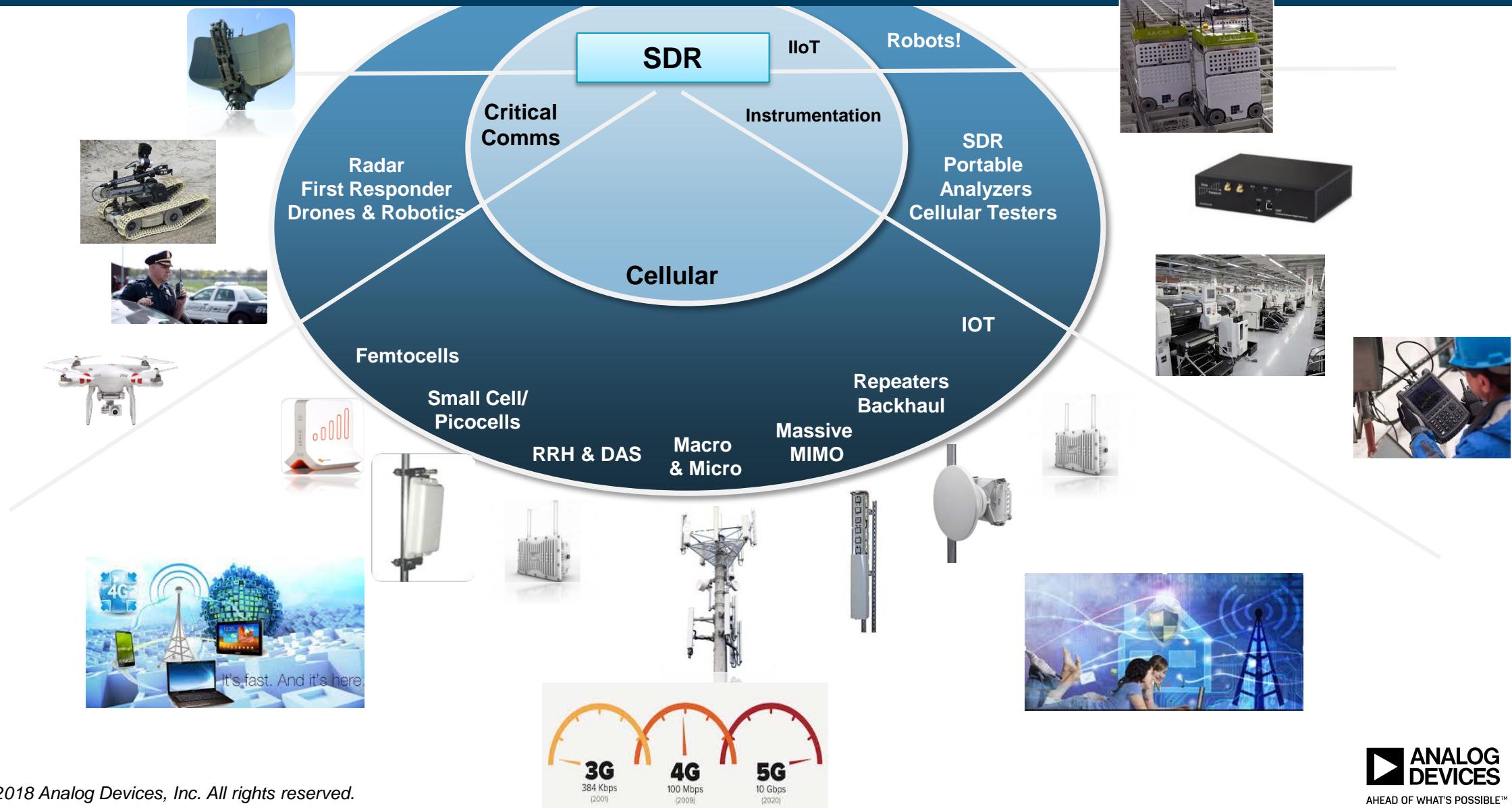
AHEAD OF WHAT'S POSSIBLE™

RadioVerse

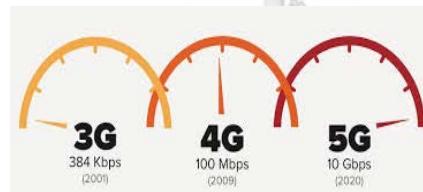
FROM CHIPS,
TO SOFTWARE,
TO HDL,
TO SYSTEMS



Software Defined Radio is expanding into new applications



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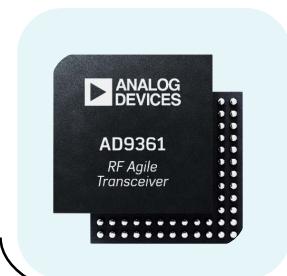
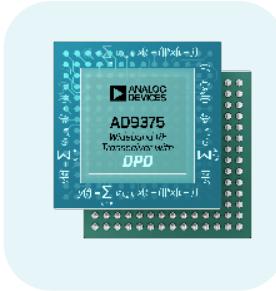



**ANALOG
DEVICES**
 AHEAD OF WHAT'S POSSIBLE™

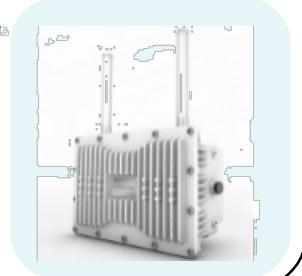
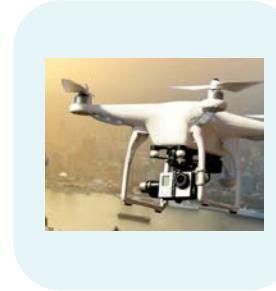
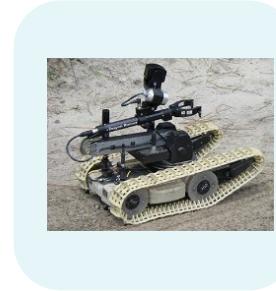
Challenge



From devices/chips:



To Products:



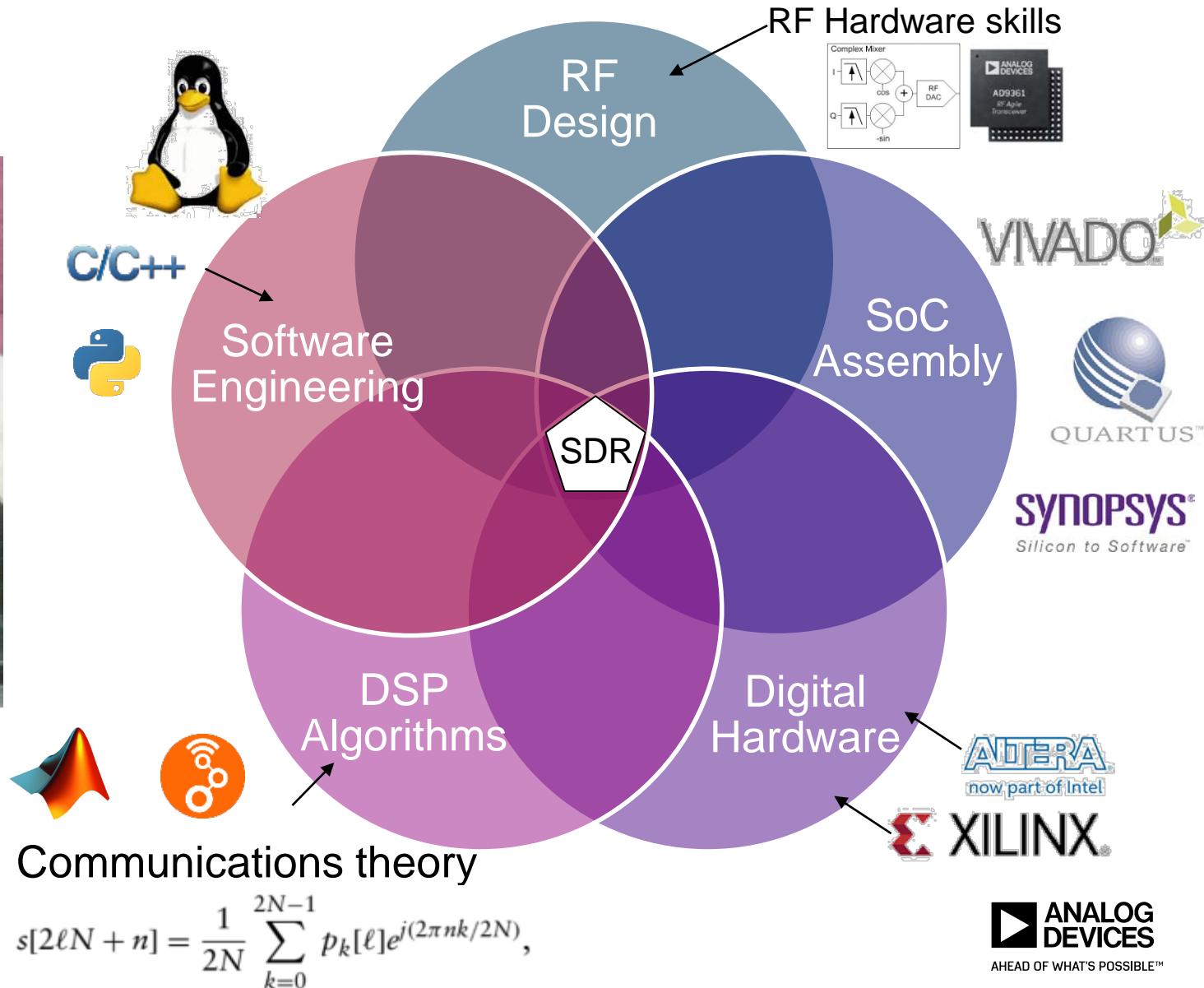
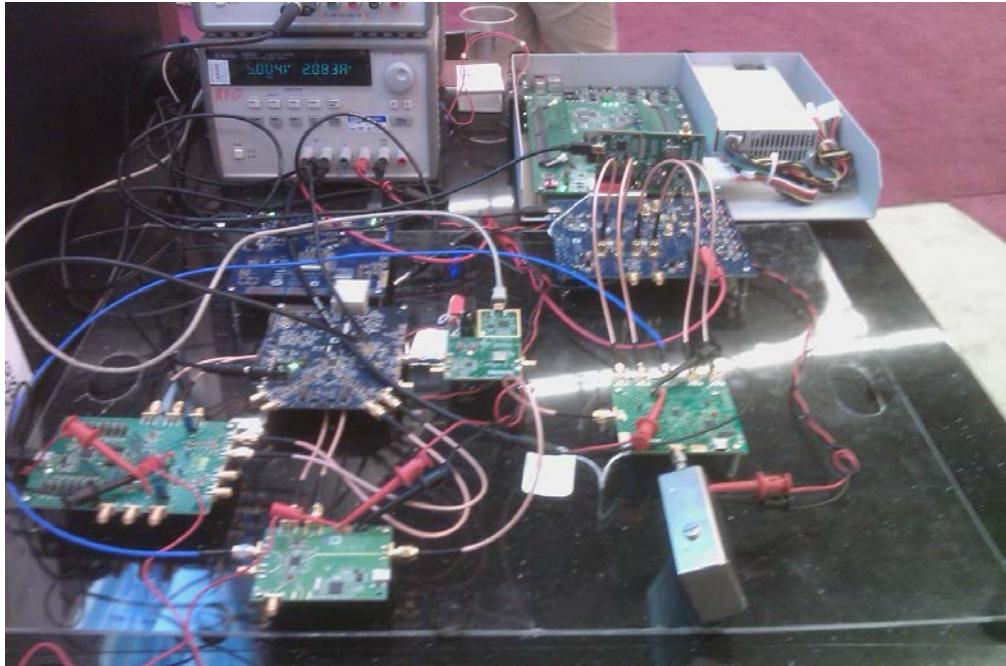
Industry/Customer Challenges for Software Defined Radio



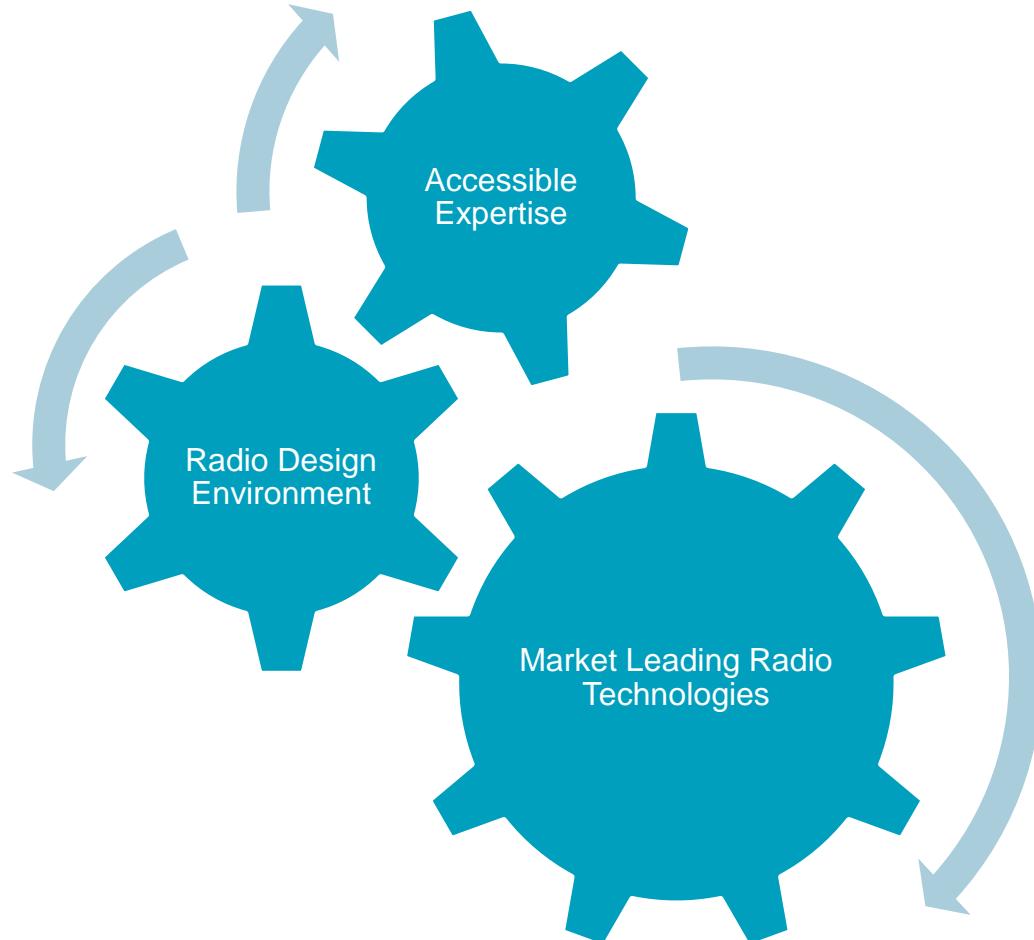
- ▶ Reducing development time & system cost
- ▶ Balancing lower power & higher performance
- ▶ Need for higher integration, reliability, re-use and secure solutions



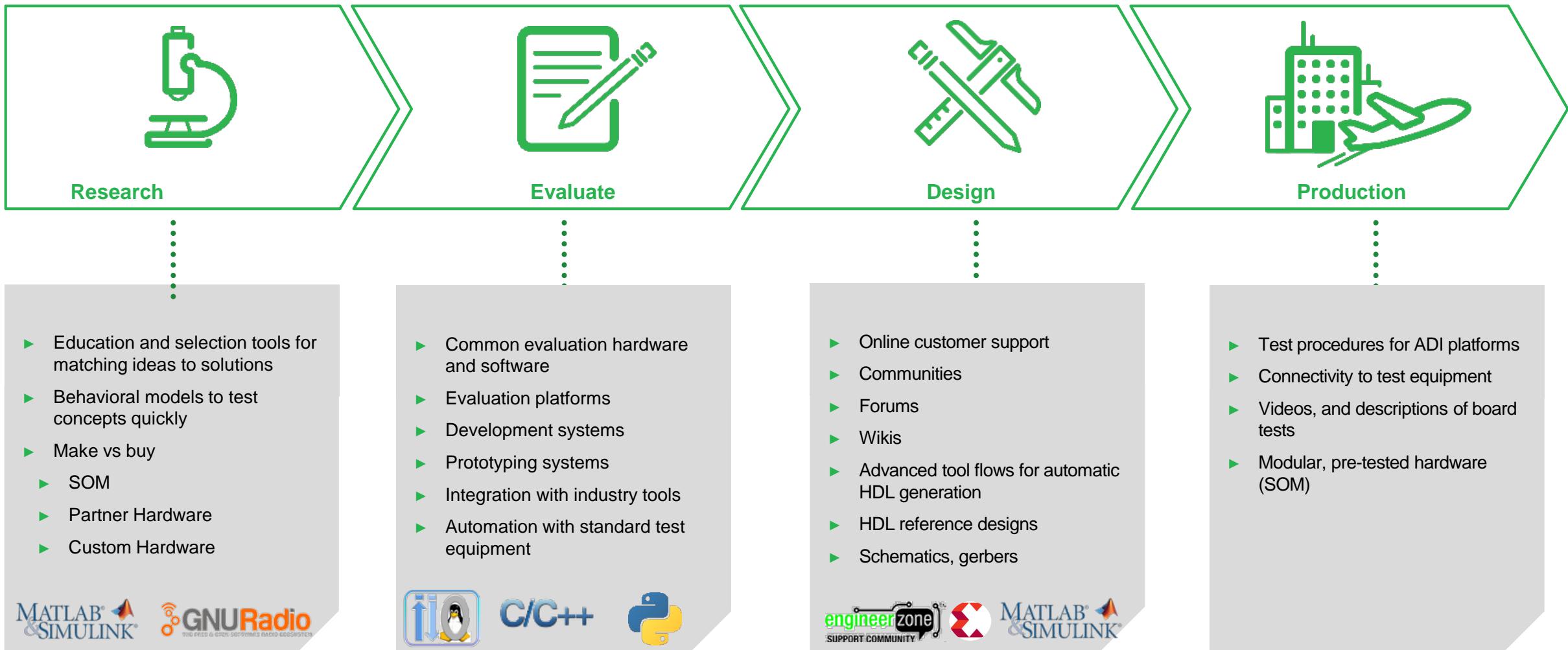
Communications and Radios are hard Software Defined Radio makes it worse!



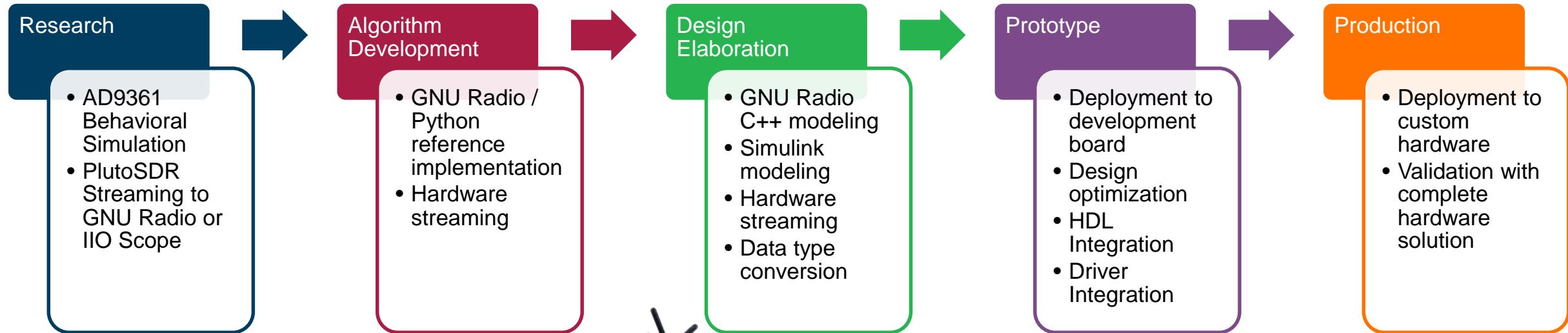
$$s[2\ell N + n] = \frac{1}{2N} \sum_{k=0}^{2N-1} p_k[\ell] e^{j(2\pi nk/2N)},$$



- ▶ **Market Leading Radio Technologies**
 - Advanced and innovative RF and mixed-signal solutions targeting applications where robust performance, power consumption, and footprint are critical success metrics.
- ▶ **Radio Design Environment**
 - we provide board support packages, software, tools, reference designs, and modules
- ▶ **Accessible Expertise**
 - support and education with our technical experts



As developers move, their hardware/software requirements change



PlutoSDR

Streams over USB

Includes : Host Libraries (libiio, libad9361-iio), GUI Software, GNU Radio and MATLAB application interfaces



RFSoM+FMC Carrier or Eval FMC + FPGA Carrier

Streams over USB/Ethernet, allows access to FPGA and local CPU (standalone operation), blue wire to HW

Includes above plus : Device Drivers, HDL interfaces, HDL libraries, Schematics, Gerber



PackRF or RFSoM + Custom Carrier

Prototype field testing, trials or bake off

Includes above plus standard peripheral access (screen, battery, GPS, PoE, Audio, etc)



Custom

Does whatever you want

Could include one or more or none of ADI: Host Libraries, GUI Software, Device Libraries, Device Drivers, HDL, Schematics, Gerber



RadioVerse Evaluation and Prototyping Hardware



AD-FMCOMMS2

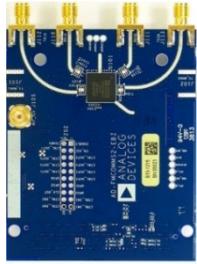
AD-FMCOMMS3

- AD9361
- 2 x Rx, 2 x Tx
- *tuning range*
 - 2.2 GHz – 2.6GHz
 - 70 MHz – 6GHz
- 200kHz - 56 MHz channel bandwidth !



AD-FMCOMMS4

- *AD9364*
- 1 x Rx, 1 x Tx
- 70 MHz – 6GHz tuning range
- 200kHz - 56 MHz channel bandwidth
- Shipping Now!



ARRADIO

- AD9361
- HSMC, not FMC
- 2 x Rx, 2 x Tx
- *2.2 GHz – 2.6GHz tuning range*
- 200kHz - 56 MHz channel bandwidth
- Shipping Now!



AD-FMCOMMS5

- *2 x AD9361*
- 4 x Rx, 4 x Tx
- *Synchronized RF*
- 70 MHz – 6GHz tuning range
- 200kHz - 56 MHz channel bandwidth
- Shipping Now!



ADRV9371-N/PCBZ

ADRV9371-W/PCBZ

- *AD9371*
- 2 x Rx, 2 x Tx, 2 x Obs, 1x Sniffer
- tuning range
 - 1.8GHz – 2.6GHz
 - 300MHz – 6GHz
- Tx synthesis bandwidth 250 MHz
- Rx BW: 8 MHz to 100 MHz



ADRV9375-N/PCBZ

ADRV9375-W/PCBZ

- *AD9375*
- 2 x Rx, 2 x Tx, 2 x Obs, 1x Sniffer
- tuning range
 - 1.8GHz – 2.6GHz
 - 300MHz – 6GHz
- *DPD actuator and adaptation engine for PA linearization*



ADRV9008-1W/PCBZ (Rx)

ADRV9008-2W/PCBZ (Tx/Obs)

ADRV9009-W/PCBZ (TDD)

- *ADRV9008-1, ADRV9008-2, ADRV9009*
- 2 x Rx, 2 x Tx, 2 x Obs, 1x Sniffer
- 75MHz - 6GHz tuning range
- Tx synthesis bandwidth 450 MHz
- Rx BW to 200 MHz



ADRV9364-Z7020

ADRV9631-Z7035

- *AD9364 + Zynq 7020*
- *AD9361 + Zynq 7035*
- 70 MHz – 6GHz tuning range
- 200kHz - 56 MHz channel bandwidth
- 1GB DDR + 32MB FLASH
- Ethernet + USB Phy



PACKRF

- *ADRV9361 reference design*
- Battery, PoE, Screen, Audio, GPS, IMU



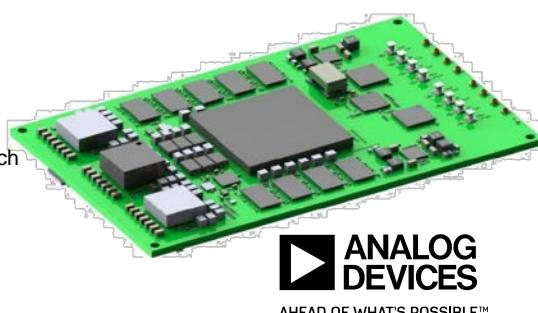
ADRV-DPD1

- *AD9375 + 250 mW PA*
- 2 Rx, 2 Rx
- LTE Band 7
- 2500 to 2570 Uplink
- 2620 to 2690 MHz Downlink
- 2 PAs, 2 LNAs, duplex filters



ADR9009-ZU11EG

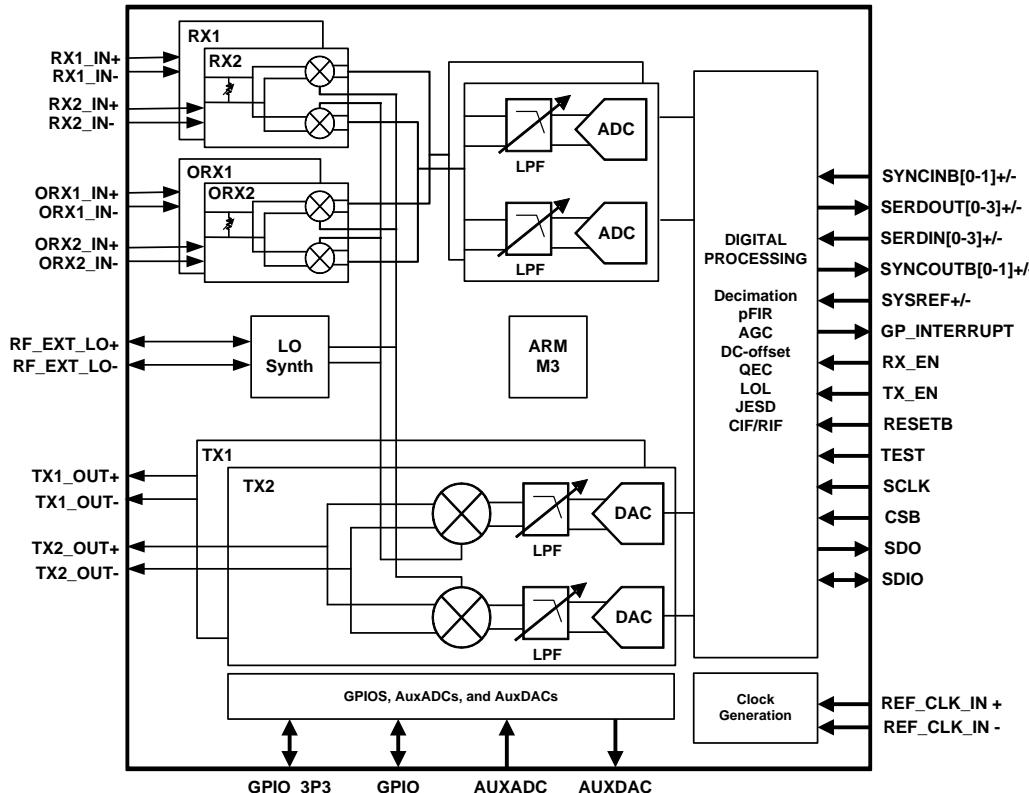
- *2 x ADRV9009 + Zynq Ultrascale*
- 75MHz to 6GHz tuning range
- Rx BW 200MHz
- Tx synthesis bandwidth 450 MHz
- Integrated LO and Phase synch between all channels and Modules
- 4G x64 w/ECC PS; 4G (2Gb x32 x2Banks) PL
- USB3, USB2, PCIe 3.0 x8, QSFP+, SFP+, 1Gb Ethernet x2, and CPRI



**ANALOG
DEVICES**

AHEAD OF WHAT'S POSSIBLE™

RF System-On-Module(ADR9009-ZU11EG)

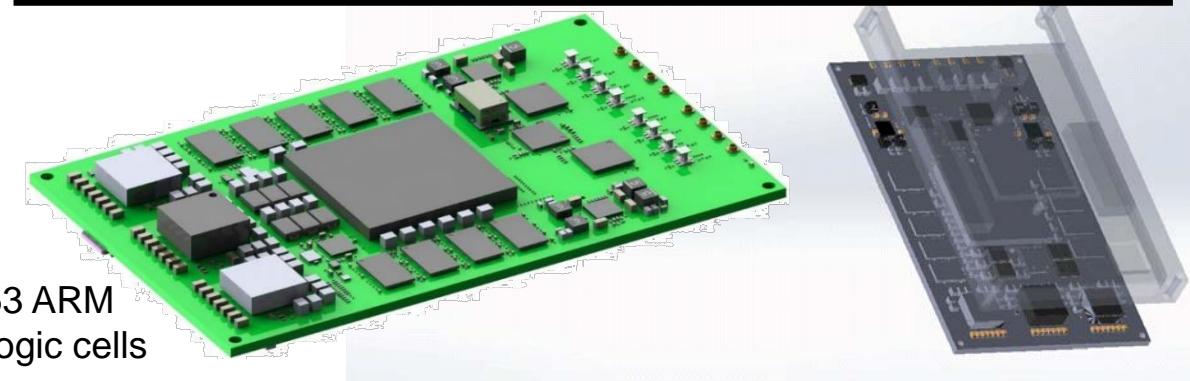
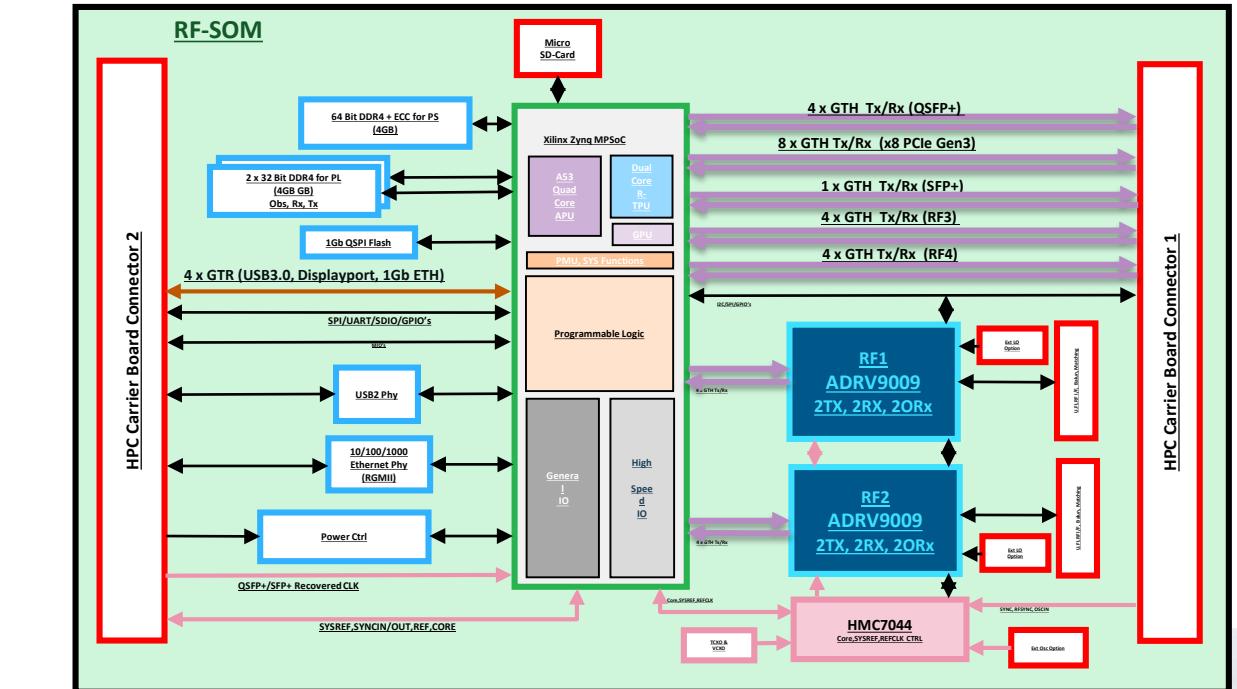


Tuning Range: 75 MHz to 6 GHz

Bandwidth: 200 MHz Receiver,
450 MHz Transmitter and Observation Receiver

Functionality:

Two Tx, Two Rx/Orx (shared channels)
Shared LO (TDD only)



- ▶ Quad Core A53 ARM
- ▶ 600k system logic cells
- ▶ 2,520 DSP Slices
- ▶ 4G x64 w/ECC PS; 4G (2Gb x32 x2Banks) PL
- ▶ USB3, USB2, PCIe 3.0 x8, QSFP+, SFP+, 1Gb Ethernet x2, and CPRI

► Description

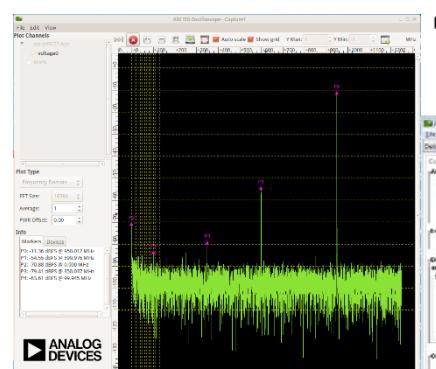
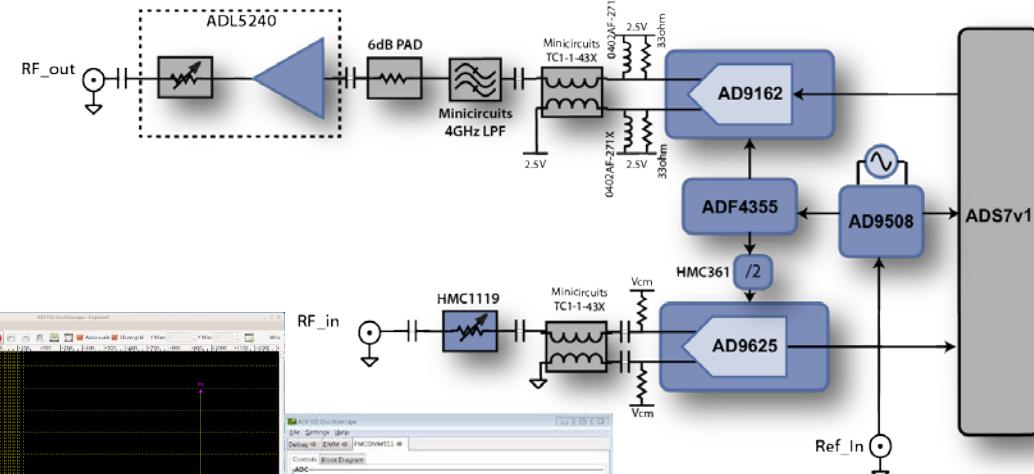
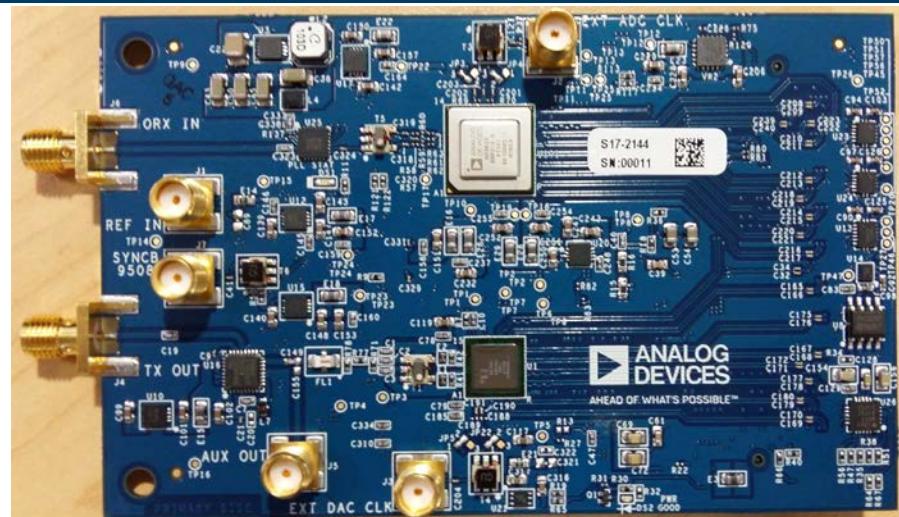
- The AD-FMCOMMS11-EBZ board is a system platform board for Direct to RF (DRF) transmitter and observation receiver architecture.
- Using high sample rate RFDAC(s) and RFADC(s), a number of components in previous generation upconvert and down convert stages can be eliminated, such as mixers, modulators, IF amplifiers and filters.

► Features & Specifications

- **650-4GHz RF Synthesis and Observation Platform (low end limited by RF transformer)**
 - Direct RF Synthesis Transmitter (AD9162)
 - 16-bit, 10.2GSPS RFDAC JESD204B interface
 - 100 MHz TO 4000 MHz RF/IF Digitally Controlled VGA (ADL5240) and a gain 31dB
 - Direct RF Sampling Observation Receiver (AD9625)
 - 12-bit 2.5GSPS RFADC JESD204B interface
 - Digital Attenuator (HMC1119) up to 31.75dB
 - 60dBc SFDR up to 3.6GHz
 - No external clocking sources or power necessary
 - Designed to work with FMC Compatible FPGA Platforms from Xilinx and Altera

► Source Code & Software

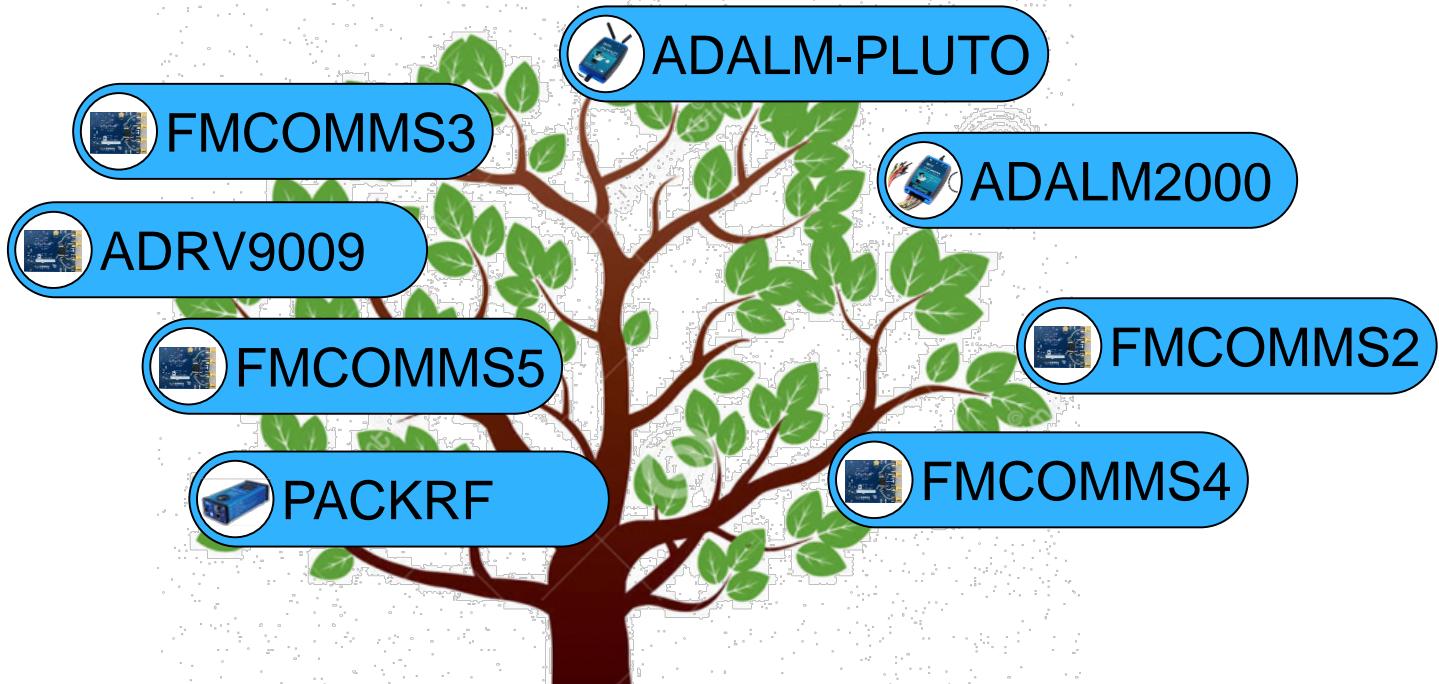
- Linux Drivers
- HDL Code
- ADI IIO Oscilloscope
- JESD204B Interface Framework



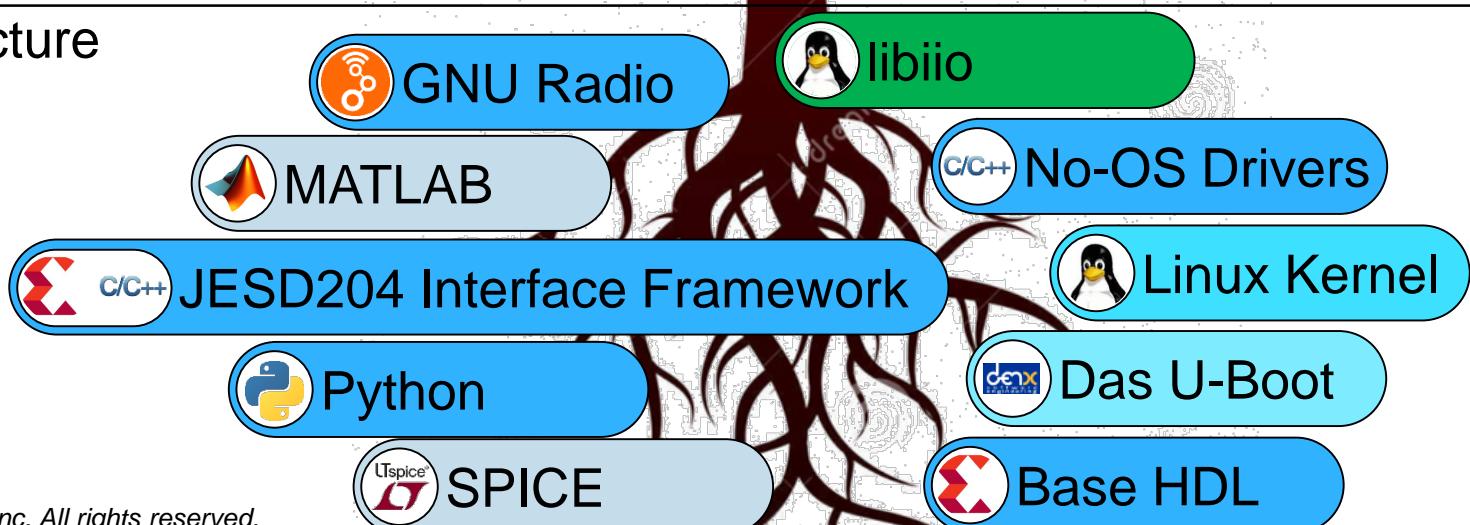
Projects are not bespoke

bespoke /bə'spōk/ : made to order

Projects



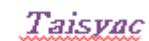
Infrastructure



Resources reach across market verticals



	Comms Infrastructure	Military Applications	Wireless Video Transmission	SDR	IoT End Node, IoT Gateway
Technology	AD9361 AD9371 AD9375 ADRV9008/9	AD9361 AD9364 ADRV9008/9	AD9361 AD9363	AD9361 AD9364 AD9371 ADRV9008/9	ADF7030, AD9361
EVB & Tools	Xilinx and Intel FPGA Carrier Platforms, ADI Capture Platforms, Mathworks Matlab® Simulink® Models, GNU Radio, JESD204B Framework Evaluation Boards, Filter Wizard, Software Tools, PA tools, Prototyping Platforms, IoT Design Kits				
ADI Reference Designs	ADRV-DPDI Small Cell Radio Reference Design	ADRV9361, ADRV9364, ADRV9009 SOM	ADRV9361, ADRV9364,	ADALM-PLUTO ADRV9361, ADRV9364, ADRV9009 SOM	ADALM-PLUTO
Partners	Benetel, NXP, Skyworks, HJX, Ettus/NI, Nanosemi	Epiq, Ettus/NI, Vadatech, Panateq	SIHID, Simpulse, Taisync, Lingwo	Epiq, Ettus/NI, Vanteon, HJX, Simpulse, Arrow, Panateq, Rincon,	Simpulse, Vanteon
3rd Party COTs Products	Ettus B200/210, B200mini, N310/300 NI USRP 2900/2901	Epiq Sidekiq / Matchstiq / Quadratiq / Maveriq / Flying Fox, Ettus N310/300, E320/310/312/313, B200/210/200mini Vadatech AMC597/VPX597/ FMC214	4 wireless video/data link solutions based on AD936x	Arrow ARRadio Epiq Sidekiq Z2 / MiniPCIe / M.2 / X2 / X4 Ettus N310/300, E320/310/312/313, B200/210/200mini, NI USRP 2900/901	Vanteon vPrism, vChameleon



Wideband Transceivers in the Real World



Sidekiq X4



Dual ADRV9009
FMC

Sidekiq Z2



AD9364

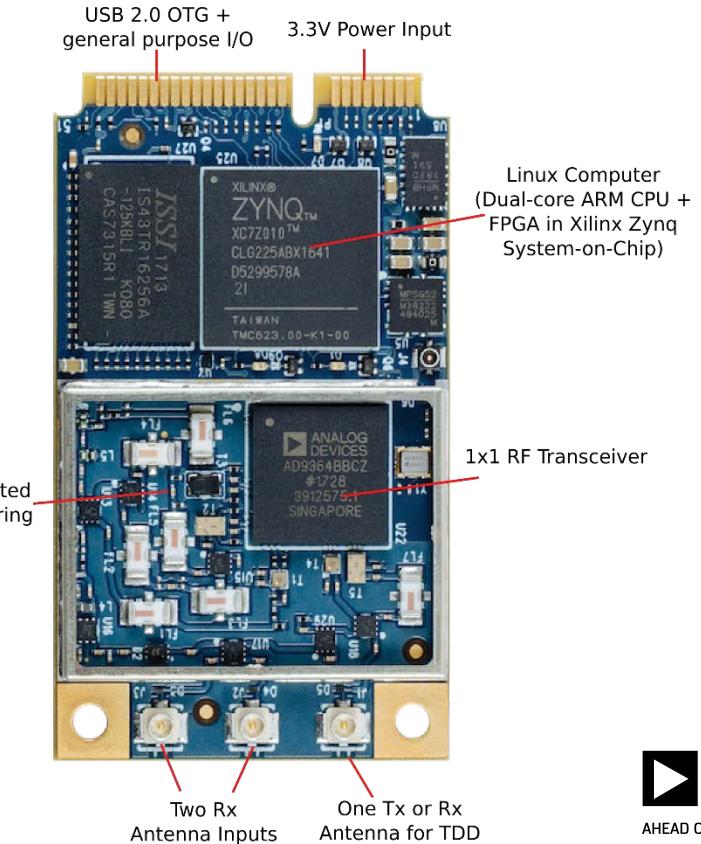
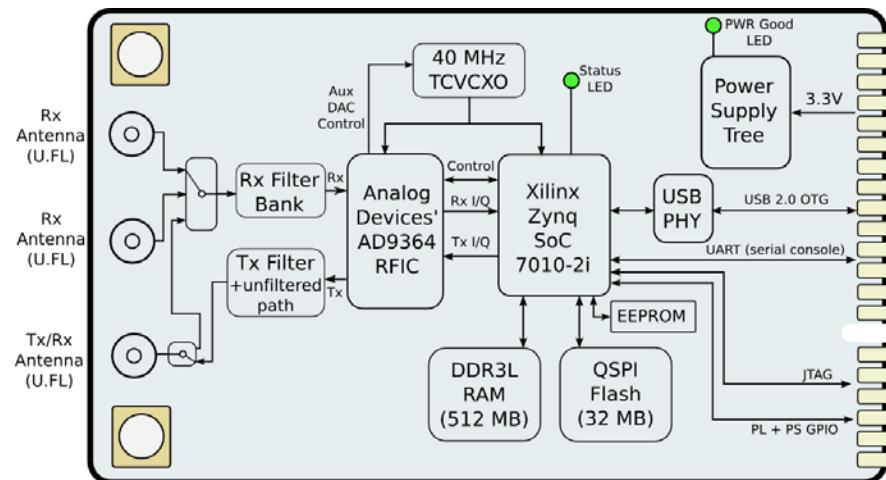
+

Linux computer
MiniPCIe

Sidekiq Z2 – An Integrated Wideband Transceiver System



- Complete dual-core Linux computer + flexible RF transceiver on a MiniPCIe card.
 - Similar in function to ADALM-PLUTO.
 - Enhancements include: RF filtering, industrial rated components, 1PPM TCVCXO, dual-core processor, full 70MHz to 6GHz tuning range
- Capable of running Epiq's suite of signal processing applications locally
 - RF spectrum analyzer
 - Cell tower survey
 - Cell phone activity detection
 - Point-to-Point data link



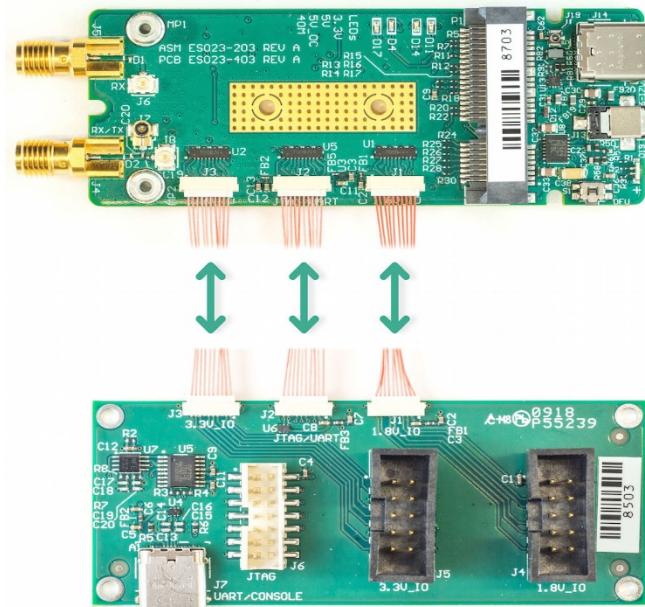
Sidekiq Z2 Evaluation Kit



Sidekiq Z2

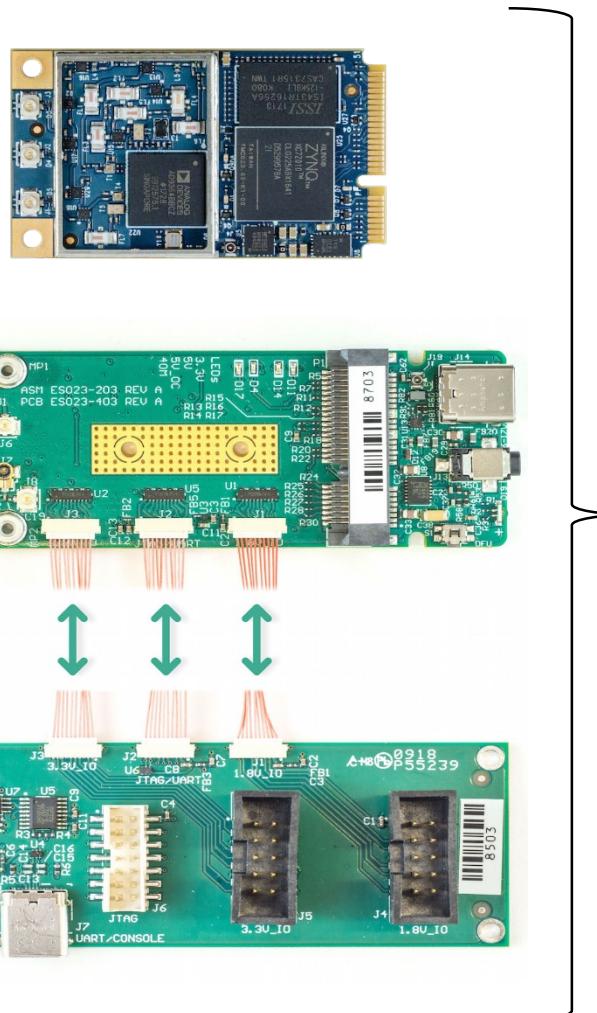
Simple Carrier Card

- SMA x 2,
- USB-C
- power input (6V-17V DC)



I/O Breakout Board

- JTAG
- serial console
- GPIO access



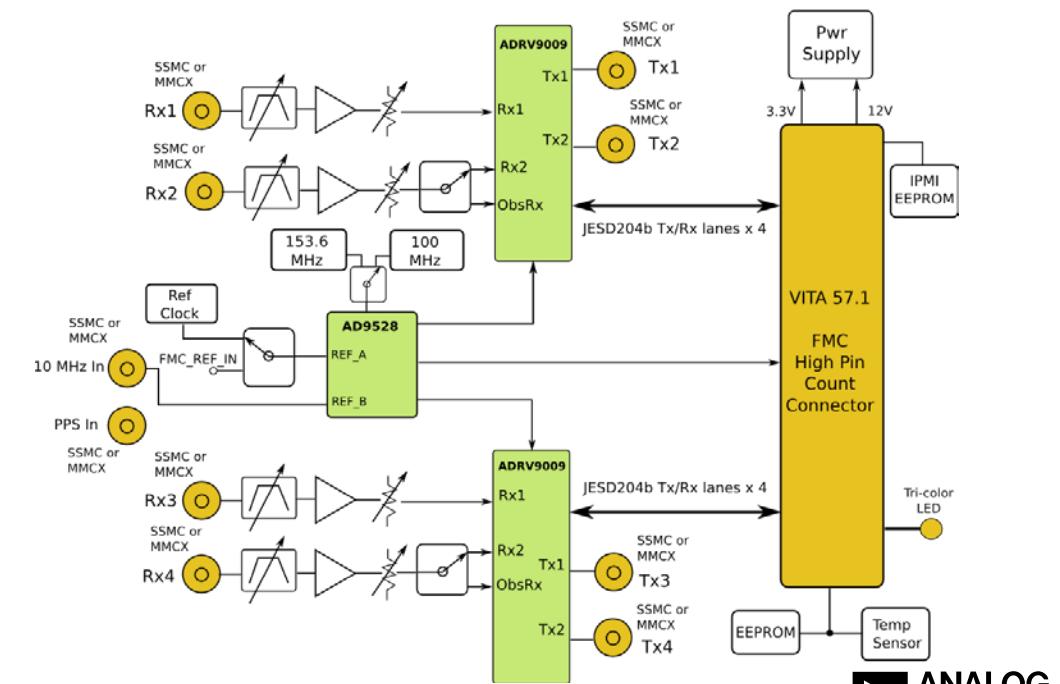
Supported by Analog Devices' IIO open source software/FPGA reference design



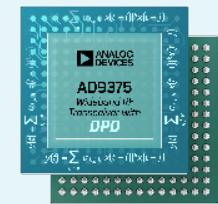
Sidekiq X4



- VITA57.1 (FMC) Card
- Based on dual Analog Devices' ADRV9009 RFIC
- SSMC (convection cooled) or MMCX (conduction cooled) connector interface
- Rx
 - Two Phase coherent Rx pairs (75 MHz to 6 GHz) with phase sync
 - <8 dB target NF and > +8 dBm target IIP3
 - 16-bit A/D converters, up to 200 MHz BW
 - Phase noise improved by another ~5-7 dB
 - Rx pre-select filtering
- Tx
 - Two phase coherent Tx pairs (75 MHz to 6 GHz) with phase sync
 - +5 dBm Tx output power
 - 14-bit D/A converters, up to 200 MHz BW
 - Phase noise improved by another ~5-7 dB over current Sidekiq X2
- 10 MHz + PPS input

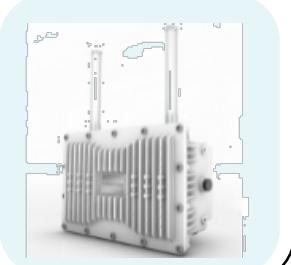


Solution



- ▶ Devices
- ▶ HDL
- ▶ Software, drivers, libraries
- ▶ Simulation,
- ▶ Tool Integration
- ▶ Schematics, Gerbers
- ▶ System on Module
- ▶ Partners

To Products:



Thanks



Community

Connect with Engineering Experts
and Resources



Access exclusive content to stay informed.



 **EngineerZone™**
ANALOG DEVICES SUPPORT COMMUNITY

- ▶ Get support from ADI engineers covering nearly 100 forums
- ▶ Read one of our engaging blogs

 **AnalogDialogue**

- ▶ Read the technical journal 25,000 engineers rely on

 **MyAnalog**

- ▶ Subscribe to get alerts and news delivered to your inbox

Workshops

► Introduction to the ADALM-PLUTO SDR, Linux's IIO, and Open-Source Toolchains

- This workshop will provide a thorough and practical introduction to the AD9361, the ADALM-PLUTO SDR, and other IIO based hardware and the open-source software toolchain (IIO utils and GNU Radio).
- Hands on, bring your own laptop
- Register with Eventbright

► Location:

- Sierra A+B
- Tuesday: 15:45 - 17:30
- Wednesday: 12:45 - 15:15

► Systems Programming on the IIO based radios within the IIO Framework

- In this workshop, we will demonstrate how IIO can be leveraged to control FPGA IP through a remote host PC and locally on an embedded system.
- Laptops provided
- Register with Eventbright

► Location:

- Vista A+B
- Tuesday 09:30 - 12:00