

Radios – The Wireless Interface

Part 1

Objectives

- Understand the performance requirements of each component in the RF block diagram. *Links to communications systems analysis*
- Understand the design and technology challenges for each component in the RF block diagram
- Describe implications on the radio hardware design due to various types of scaling, e.g. size, frequency, cost, power, data rate. *Links to wireless network design*

Outline

- Overview and RF Block Diagram
- Filters
- Amplifiers
- Up/Down Conversion
- Oscillators and Synthesizers
- Modulation Basics
- Antennas
- Chip-Level Radios
- Integration and Packaging

Overview & RF Block Diagram

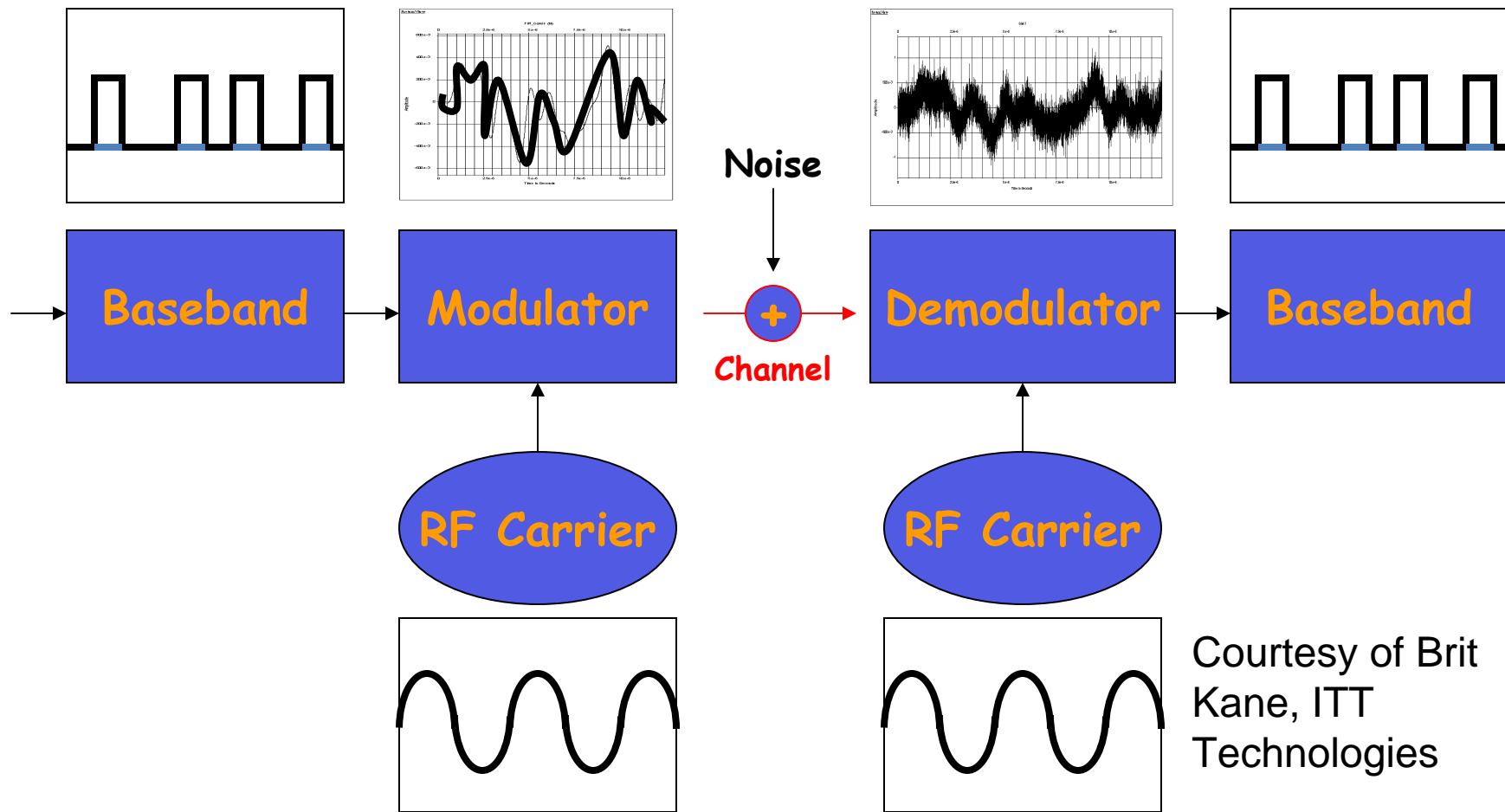
Overview and RF Block Diagram

- Functional View of the Radio
- The Role of Analog RF Hardware in Today's Radios: RF Sub-system Block Diagrams & Requirements
- Some Design and Technology Issues
- Future Front-End Technology

Functional View of the Radio

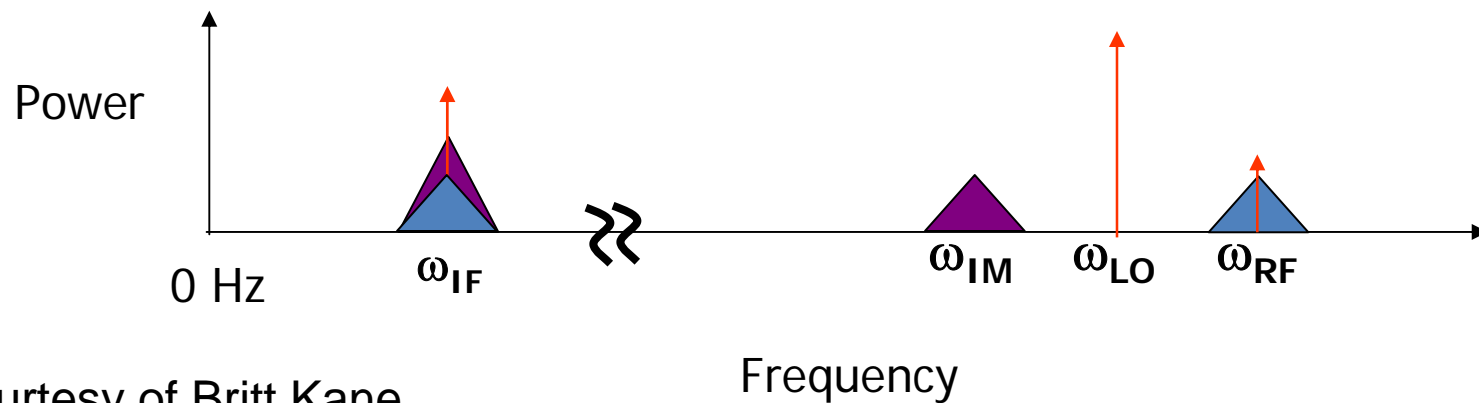
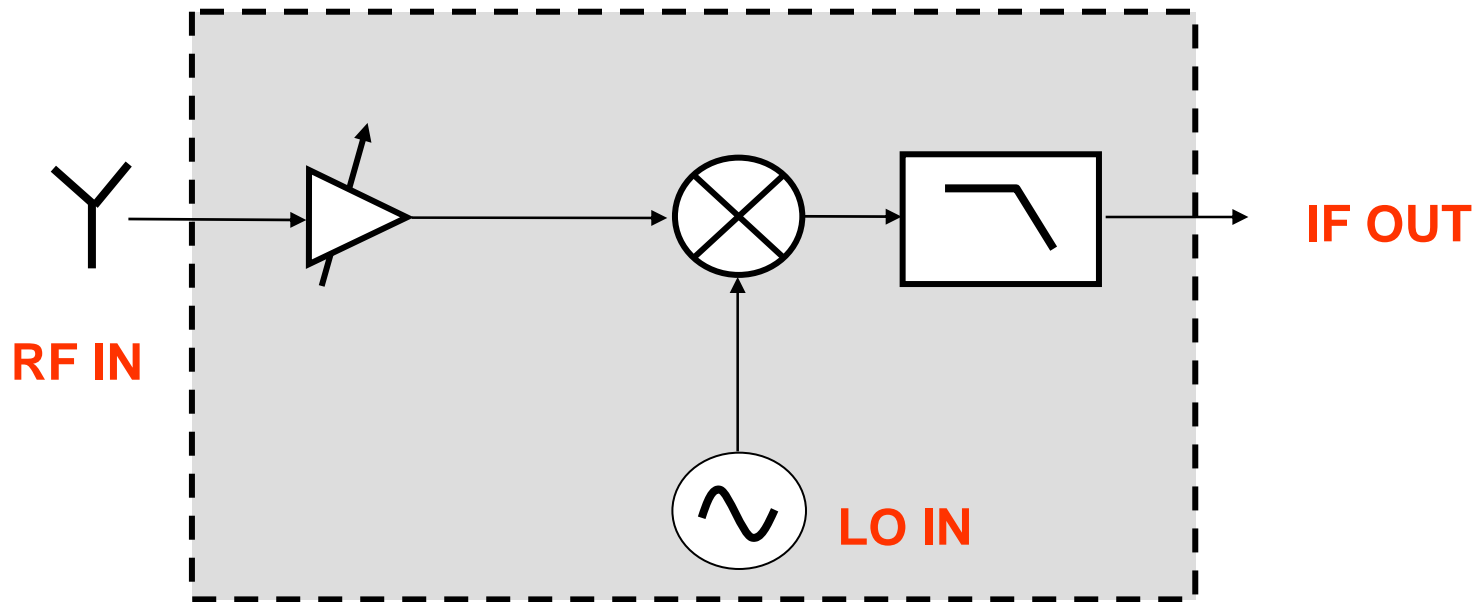
- Analog RF hardware – the link between the information (data) and the channel
- Multiple perspectives
 - High Level → how information is processed
 - Mid Level → components needed for each processing step
 - Low Level → design of each component

RF Analog Block Diagram Information Processing



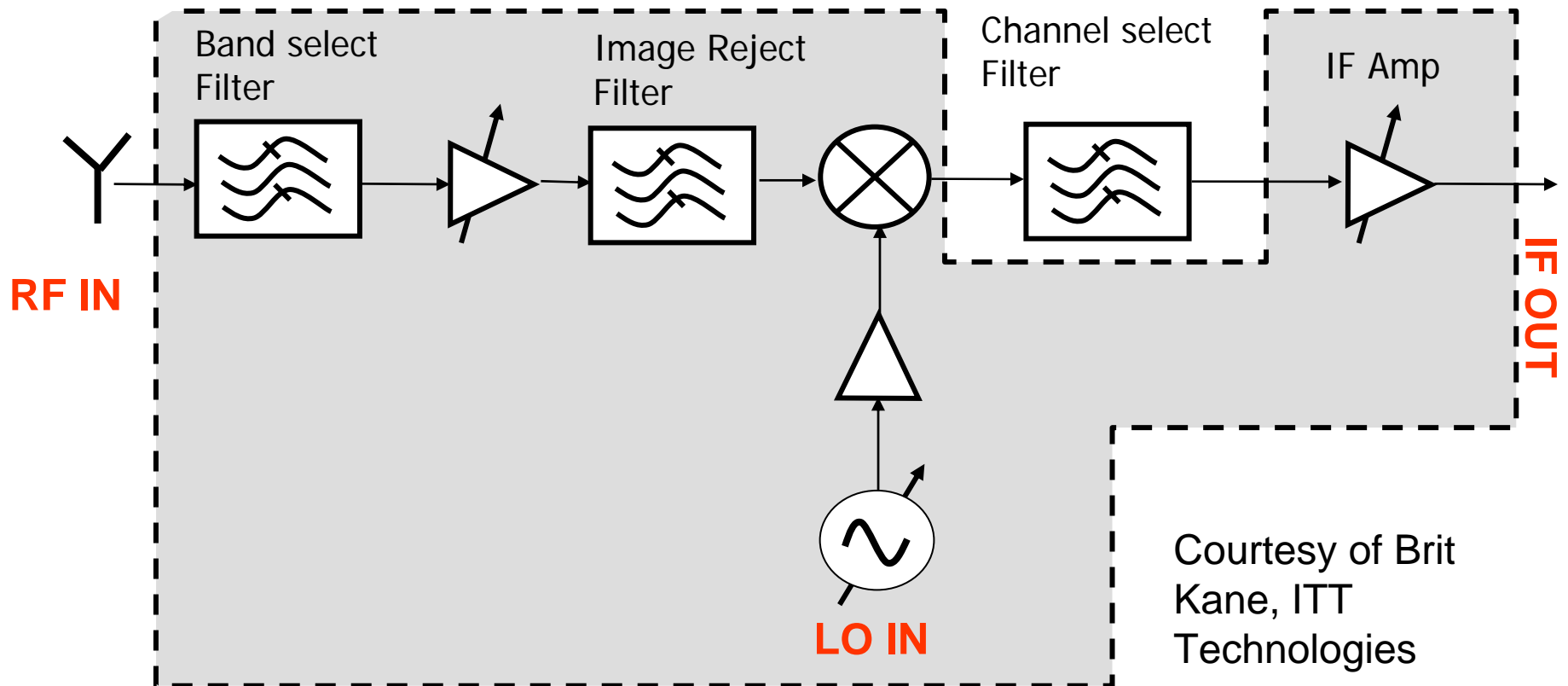
Courtesy of Brit
Kane, ITT
Technologies

RF Analog Block Diagram - Receiver

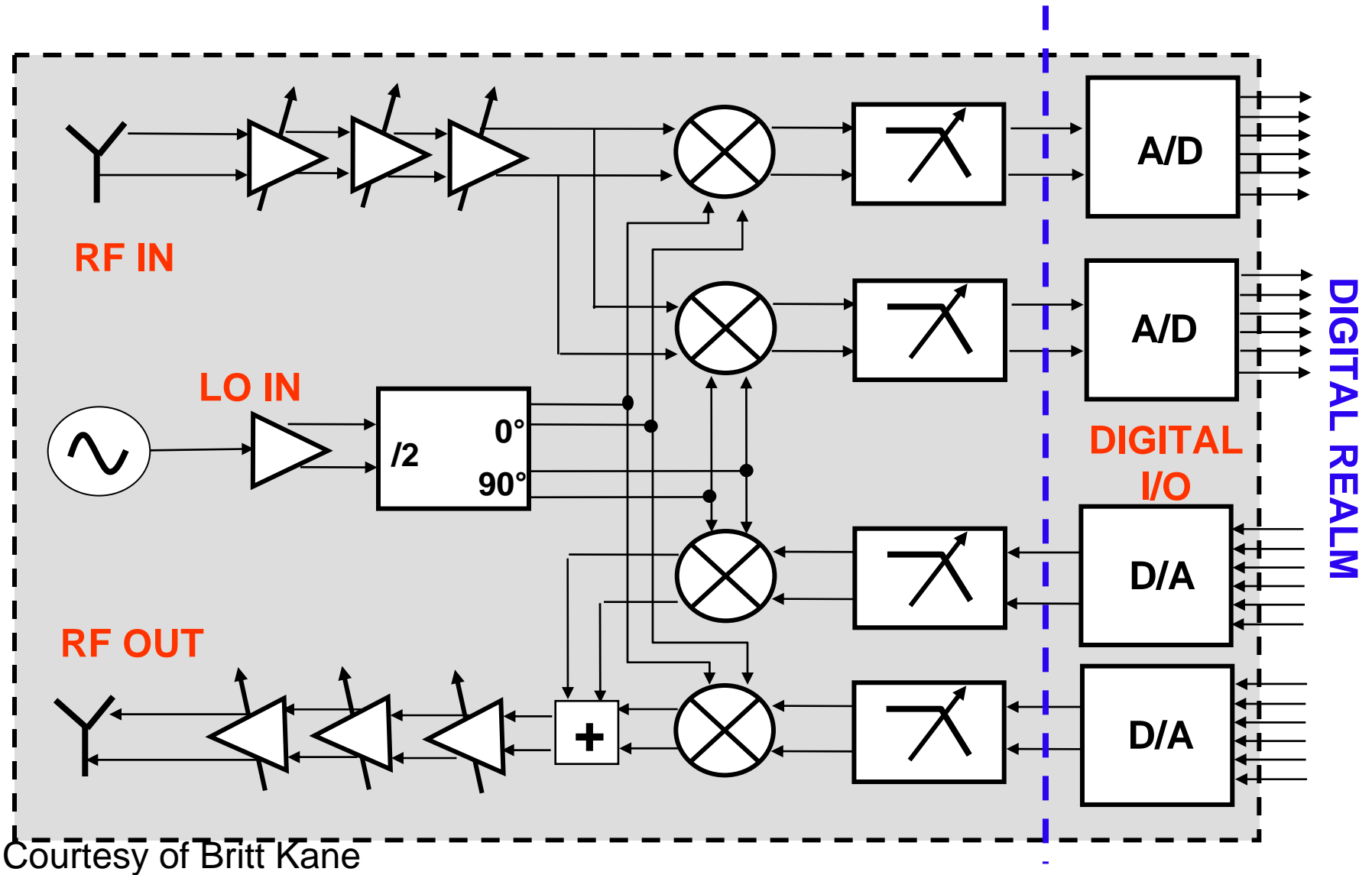


Courtesy of Britt Kane

RF Analog Block Diagram - Receiver



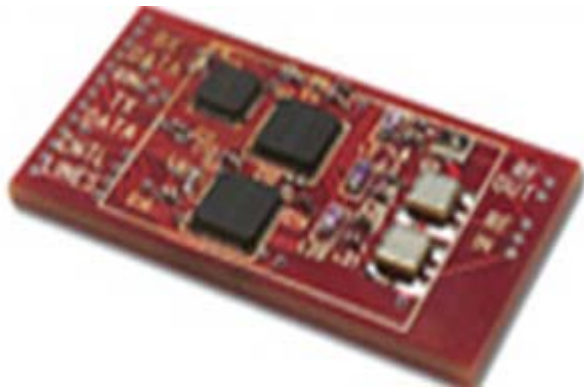
RF Analog Block Diagram



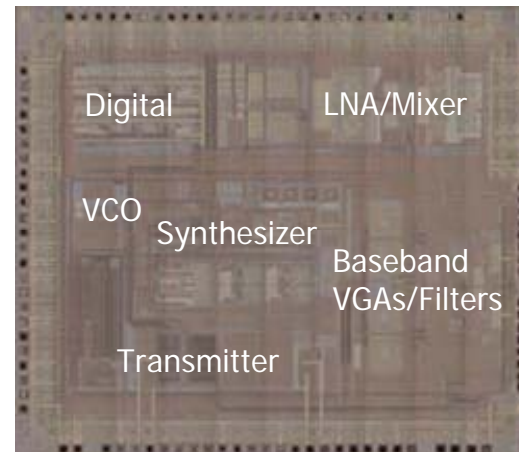
Courtesy of Britt Kane

Some Design & Technology Issues

- Form: Board Level vs. Chip Level

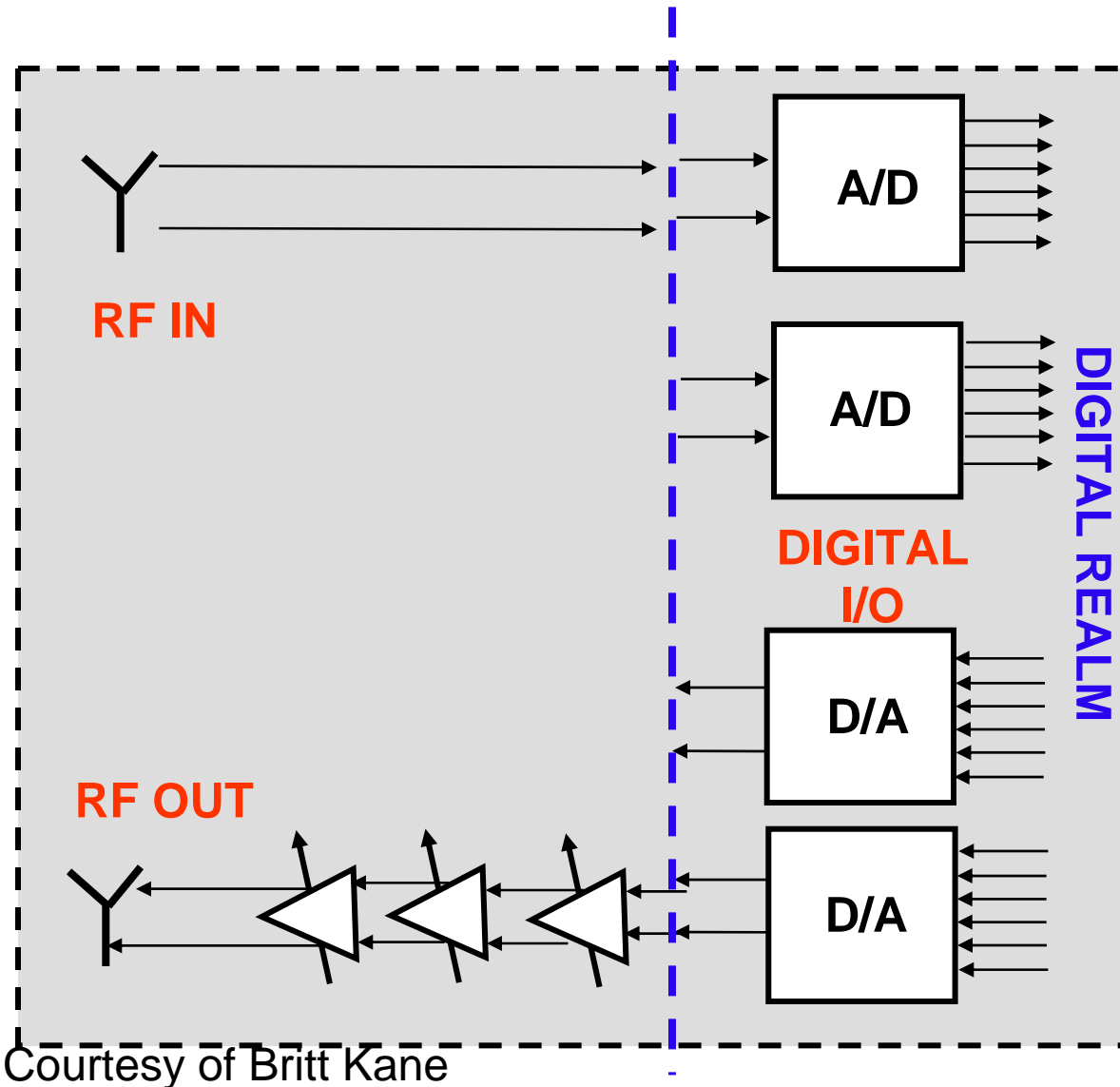


Not to scale!



- Architecture:
 - Down-conversion: Single vs. Dual vs. Zero
 - Dual-band, multi-band
 - Multi-channel, redundancy

Future Front-End Technology



Overview – Conclusions

- RF analog hardware is the pathway between the data and the propagation channel
- Functional and then component-level block diagrams are the starting points for radio design
- The radio architecture defines how functional requirements flow down to the component / device level