Antennas

Antennas – Part A

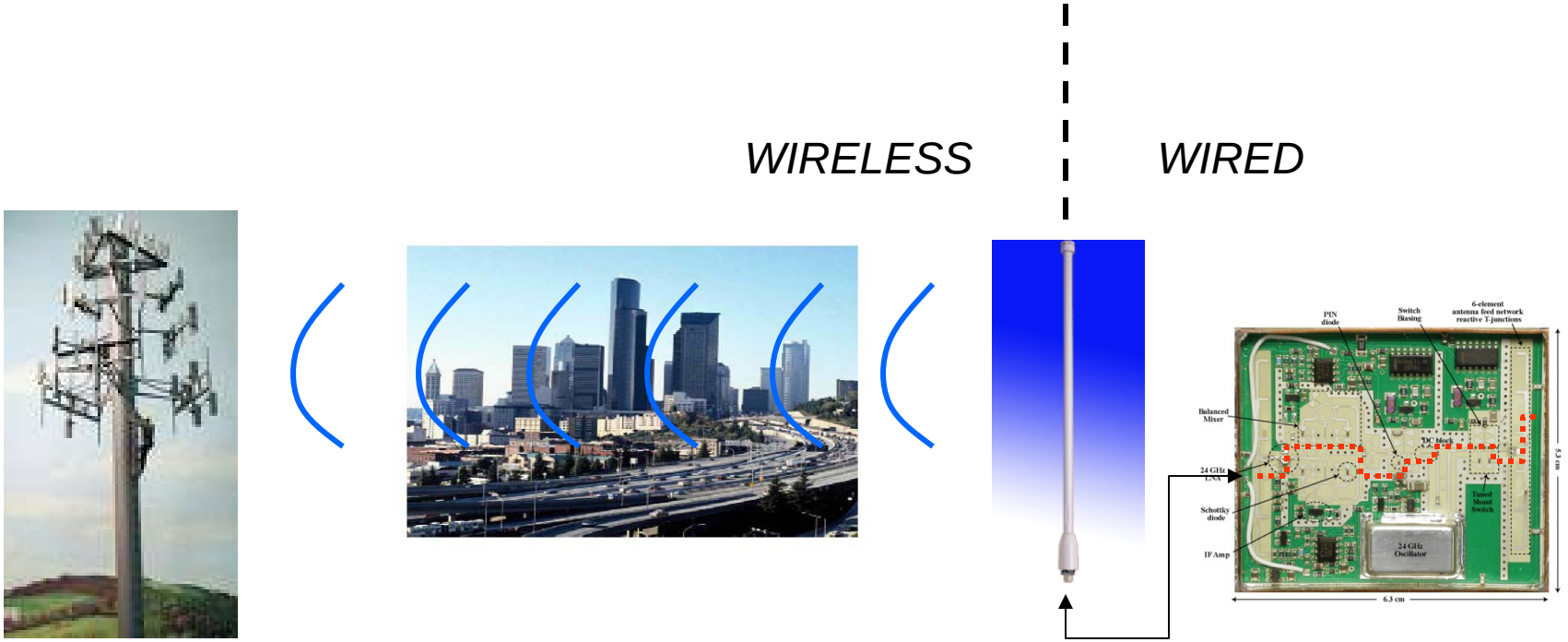
muse

Antennas

- Overview
- Performance Parameters
- Design and Technology Issues
- Types
  - Wire Antennas
  - Planar Antennas
  - Some High-Gain Antennas / Arrays
- Impact on Sensor Network Design

Overview

- For wireless devices, antennas are the interface between the ‘wired’ and the ‘wireless’ domains
  - In the ‘wired’ domain energy is guided by transmission line routing
  - In the ‘wireless’ domain energy can be directed by the antenna but is subject to multiple possible forms of interference (people, buildings, trees, cars, etc.)
- Antennas are often described as “transformers” between free-space transverse electromagnetic (TEM) plane waves and the guided waves inside a wireless device



Overview

- Transformer Concept
  - From a circuit standpoint, the antenna is a transformer between the free-space impedance (E/H = 377 Ω) and the circuit impedance (V/I, typically 50 Ω). Without this impedance transformation energy is not efficiently transferred across the wired/wireless boundary
  - From a field standpoint, the antenna is a transformer between TEM free-space waves and the EM field configuration that exists on a transmission line
  - Both standpoints illustrate how antennas straddle the “circuit” and “electromagnetic” worlds

Overview

- Reciprocity
  - Antennas receive and transmit energy identically
  - This concept is very useful in describing the behavior of antennas – sometimes it is easier to consider transmission, and other times it is easier to consider reception…we'll see specific examples in the coming slides

Overview

- How to think about antennas:
  - Reception: the antenna collects energy and appears as a source that energizes the receiver
  - Transmission: the antenna radiates energy and appears as a termination (load) to the transmitter

Performance Parameters

Efficiency

Input Impedance

Common Dipole Antenna

Polarization

Radiation Pattern

Directivity

Gain

Radiation Pattern

“Collection of Little Radiators”

Near-field: Complex E & H Fields

Far-field: Plane Waves