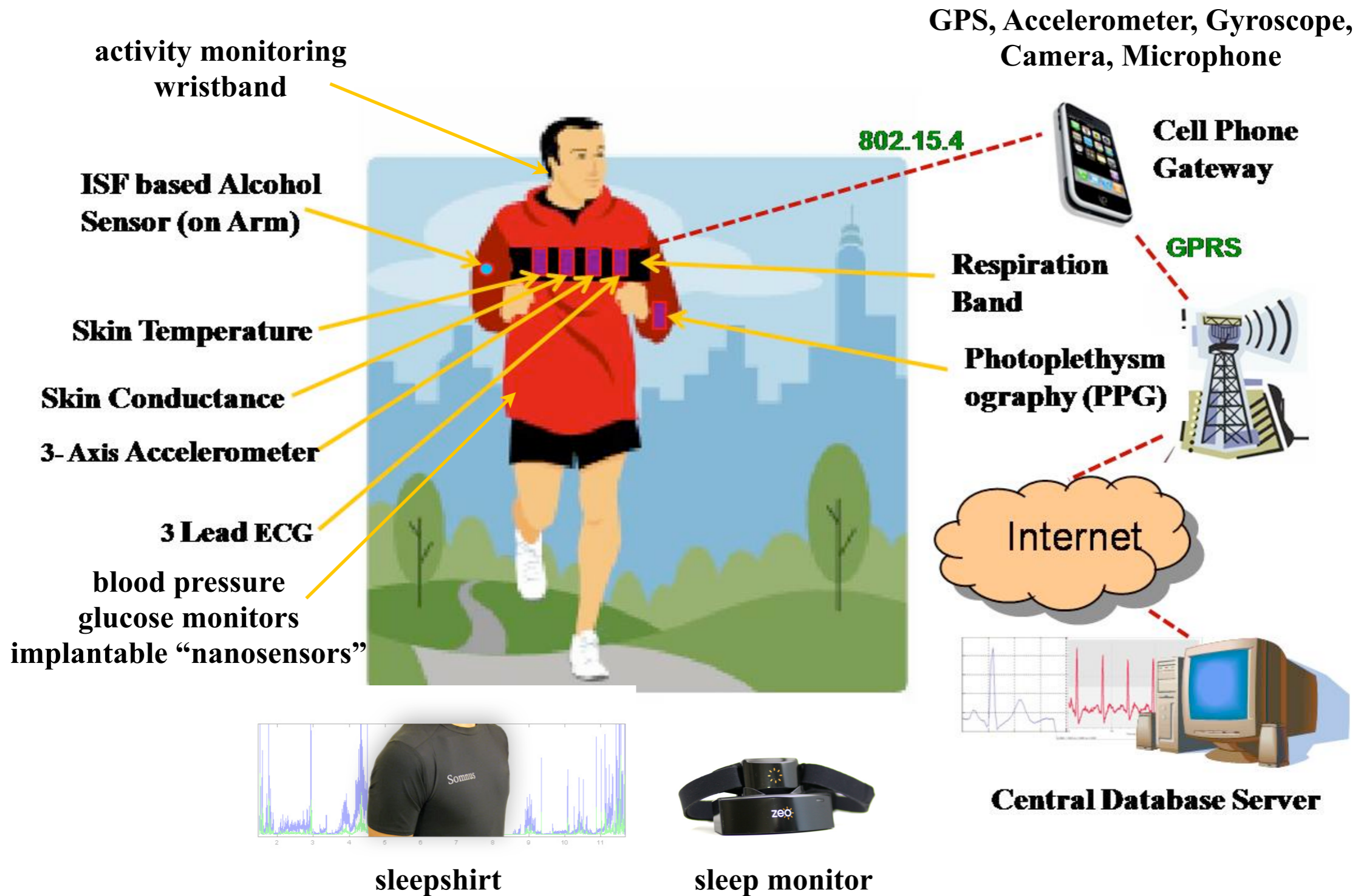


Backscatter communication for wearables/IoT

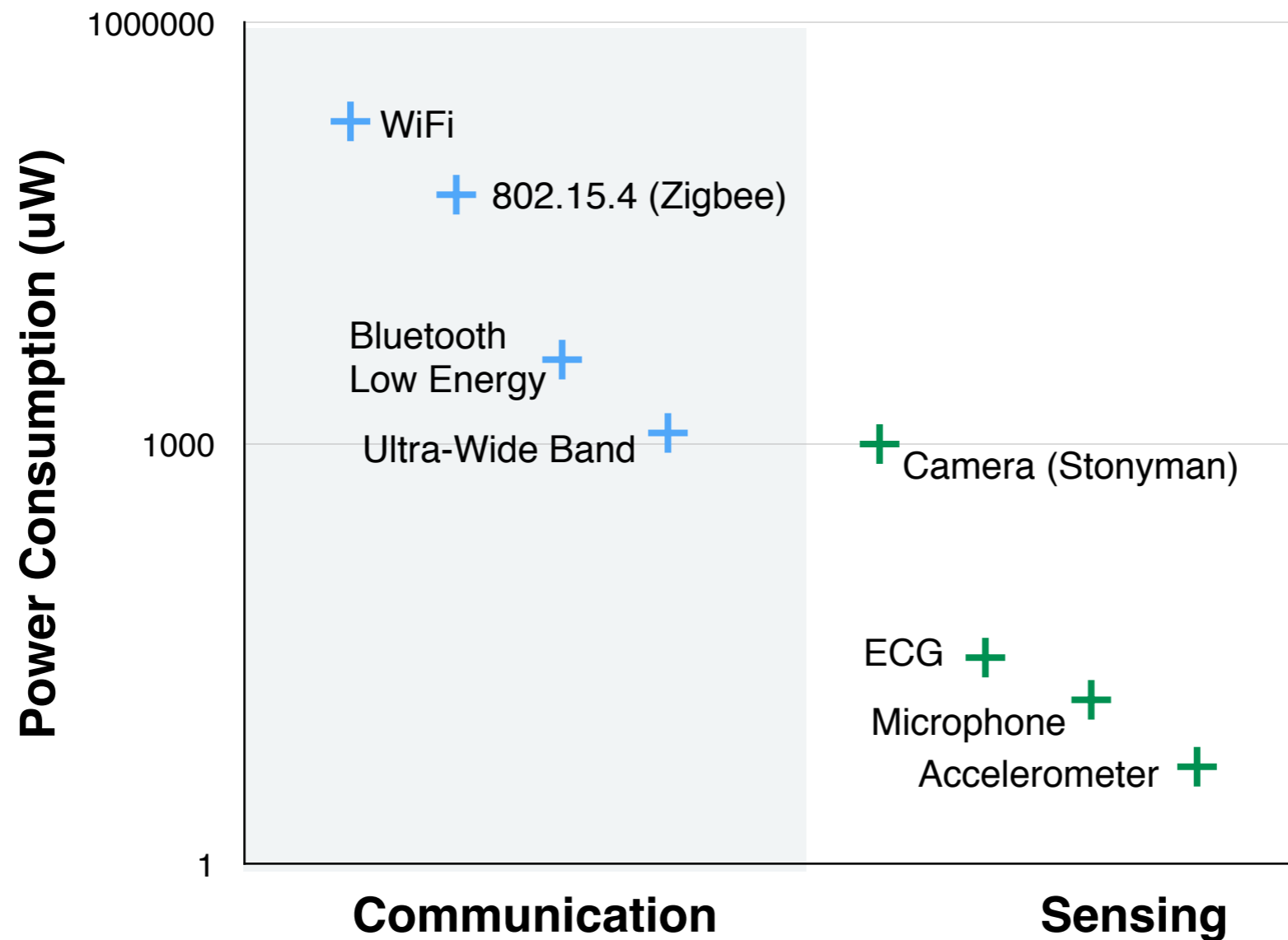
Deepak Ganesan
Associate Professor
Computer Science
UMass Amherst



Emerging ecosystem of on-body sensors

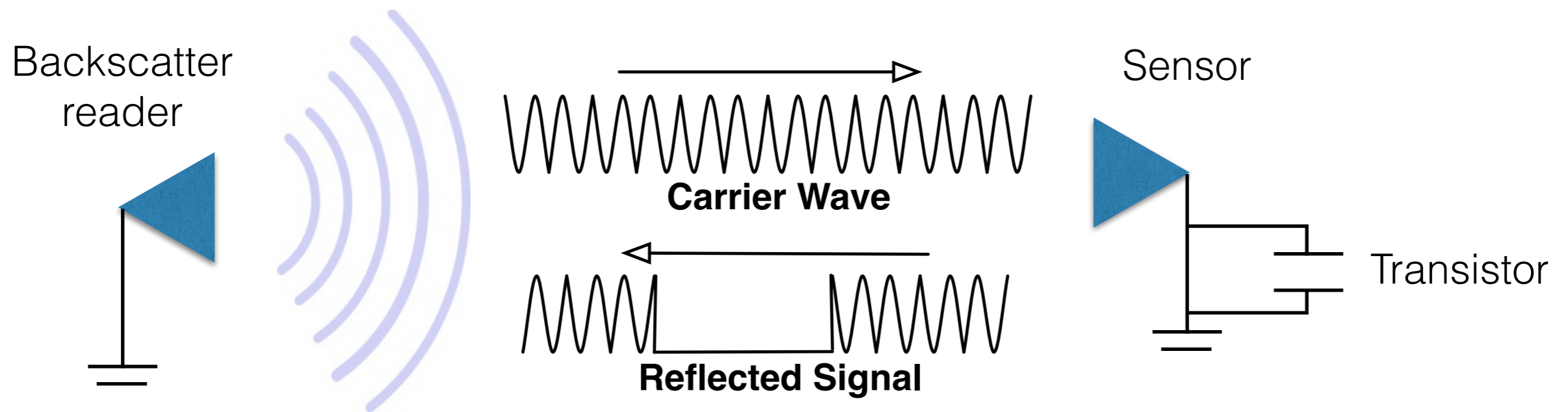


Why is communication a problem?



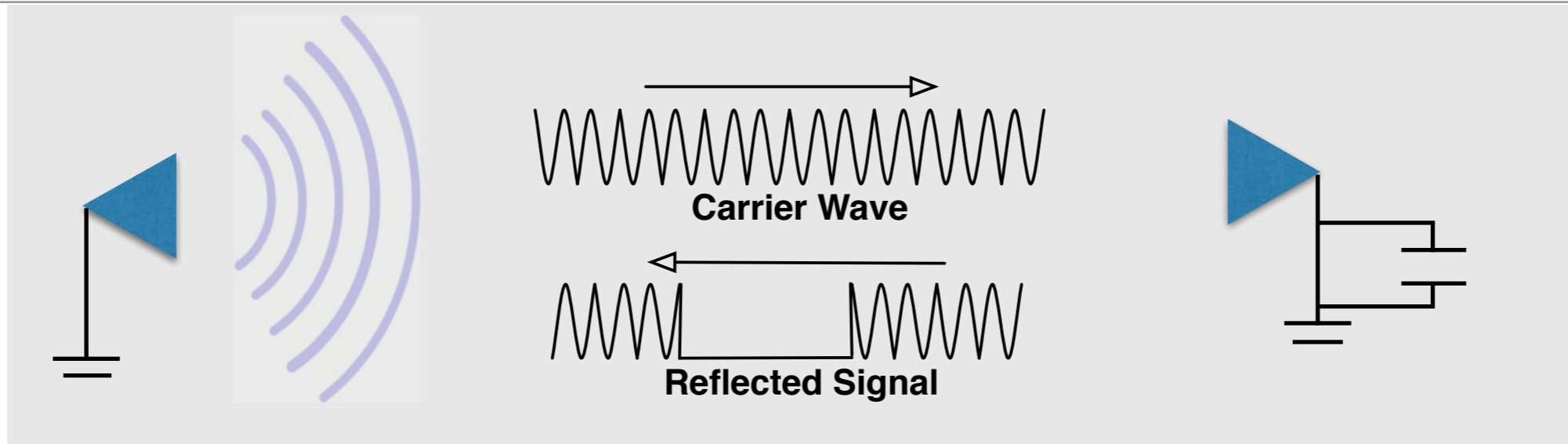
Communication is a major bottleneck for low-power operation

Backscatter communication

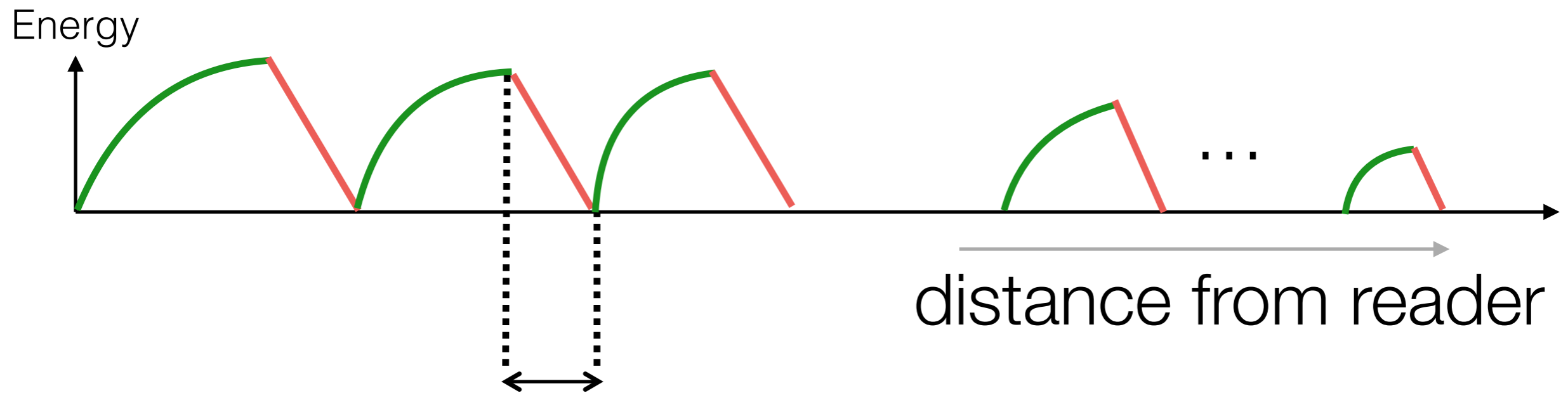
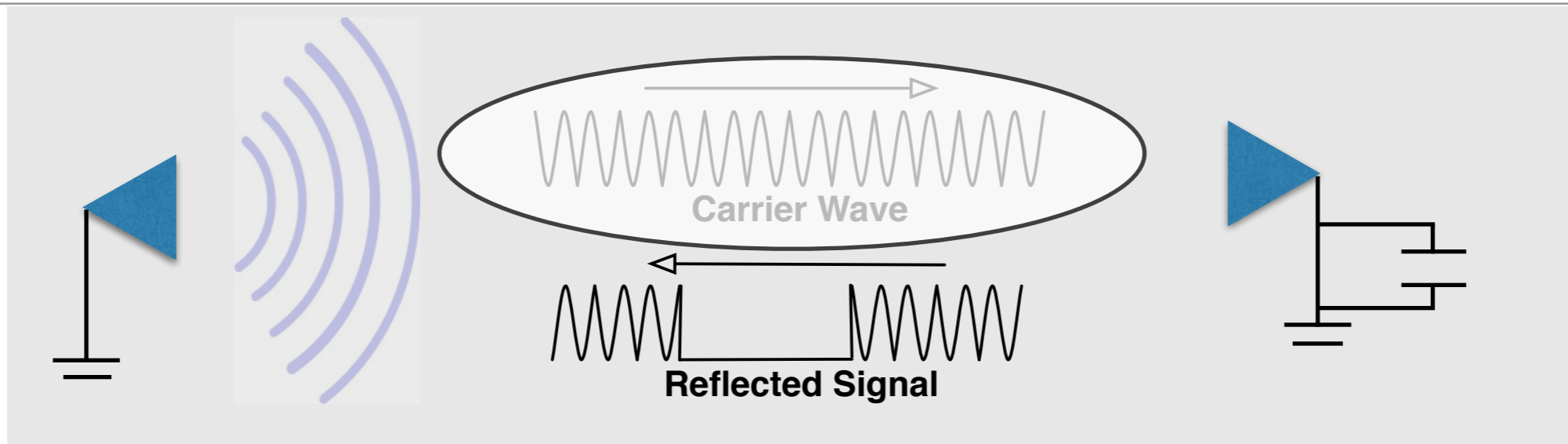


Backscatter is extremely efficient because the device is reflecting the signal rather than generating a signal.

Why is backscatter a challenging domain?



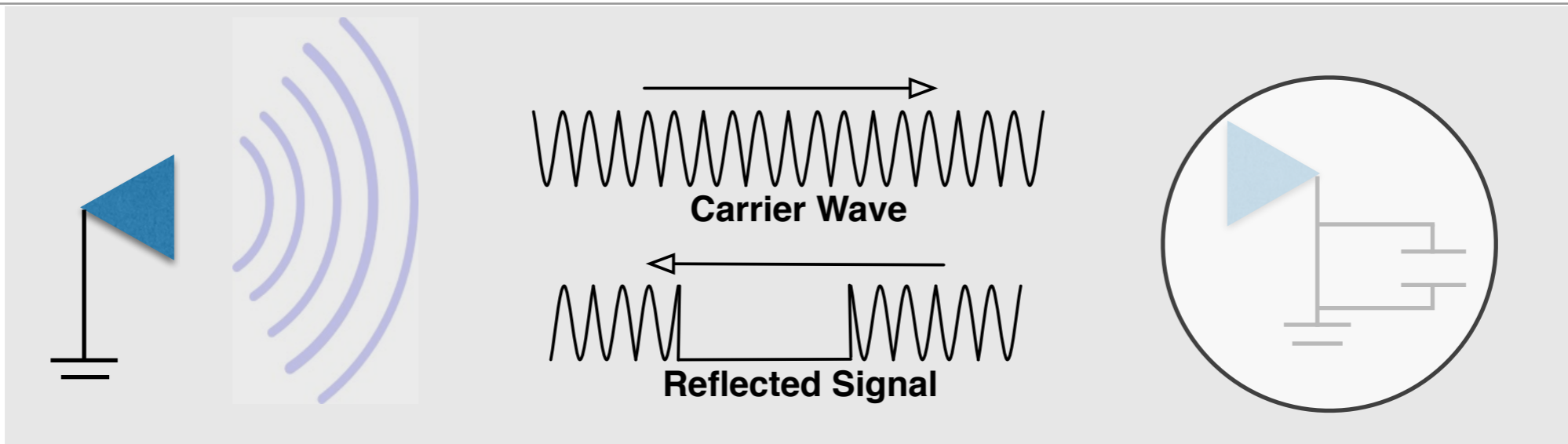
Why is backscatter a challenging domain?



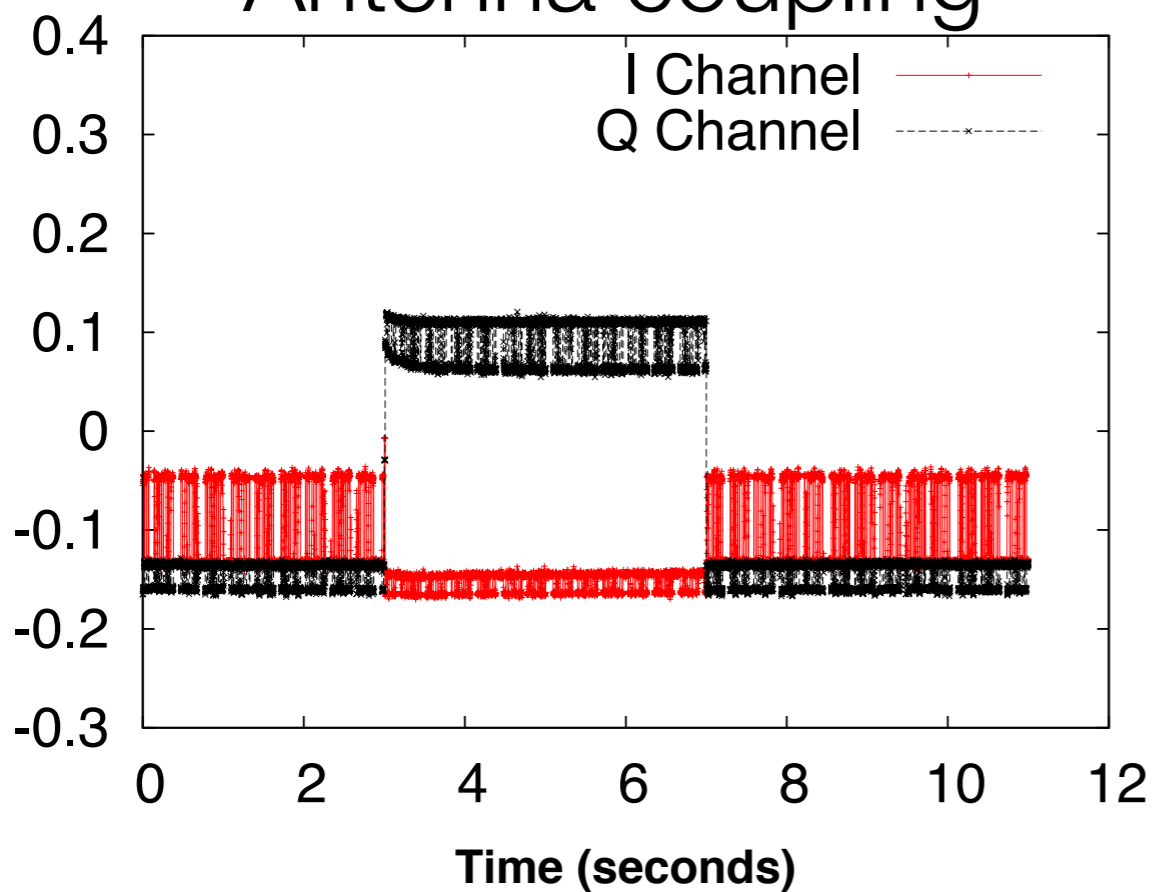
available energy is miniscule



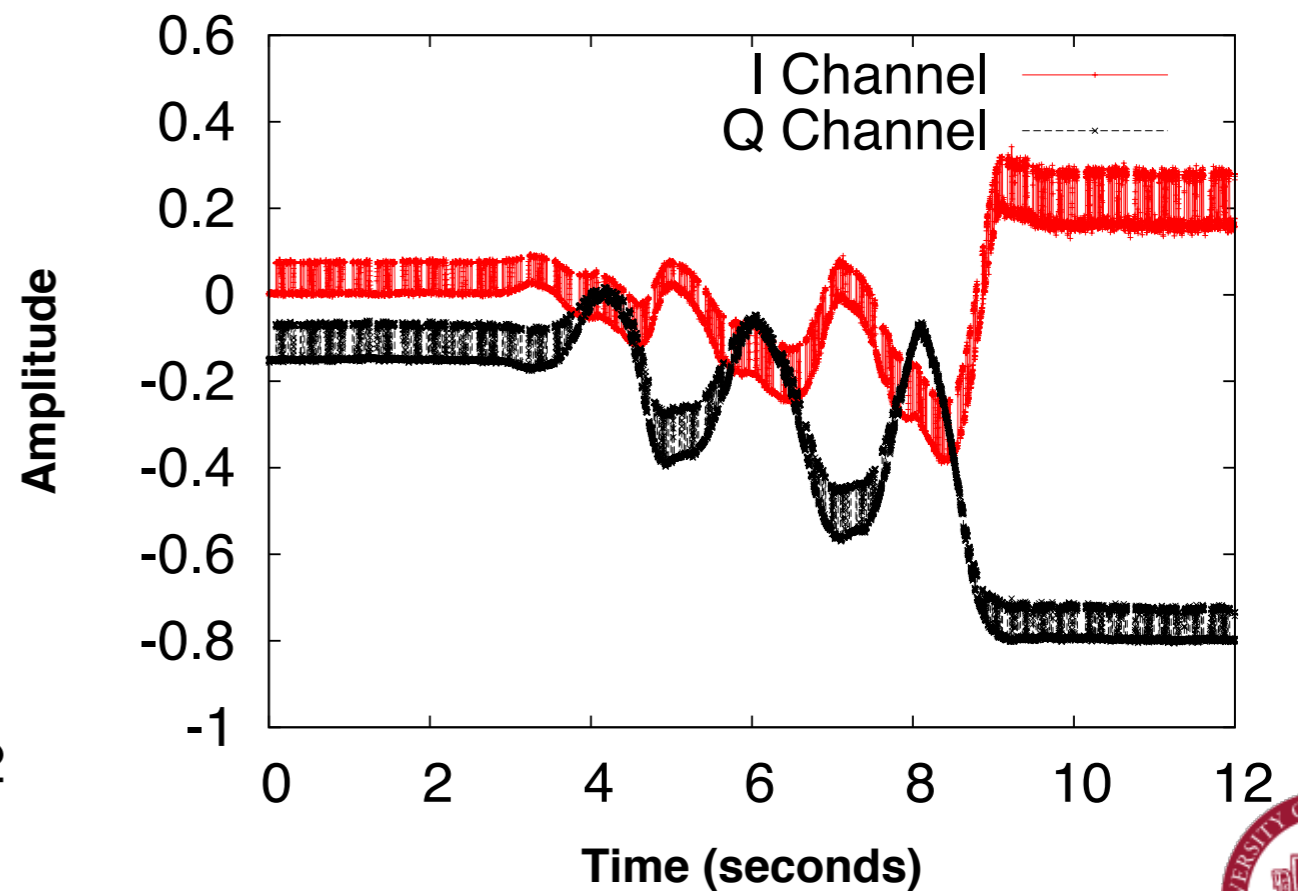
Why is backscatter a challenging domain?



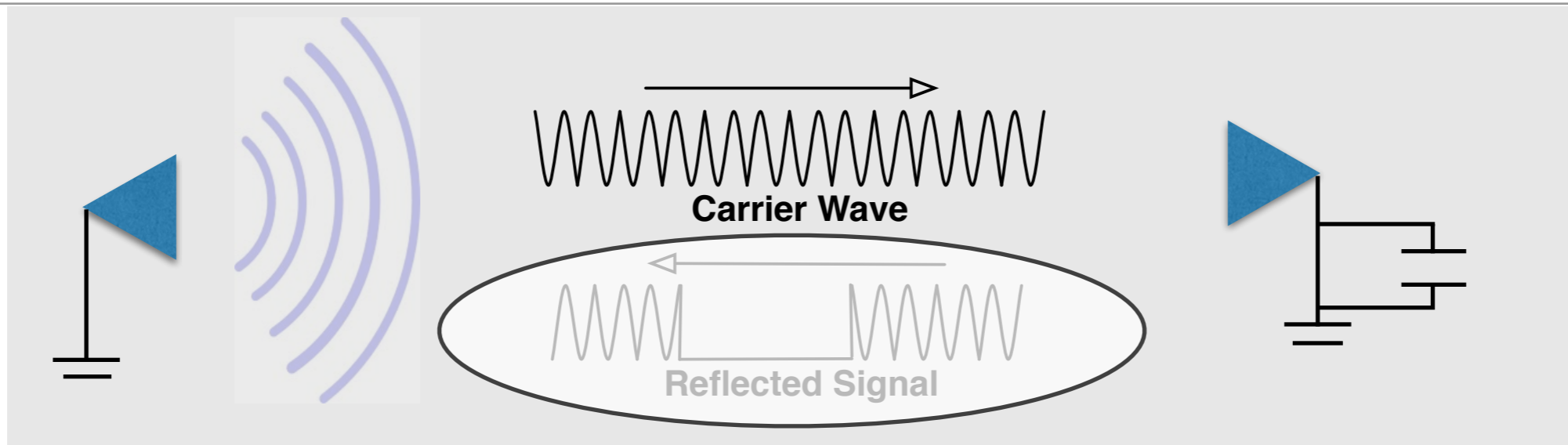
Antenna coupling



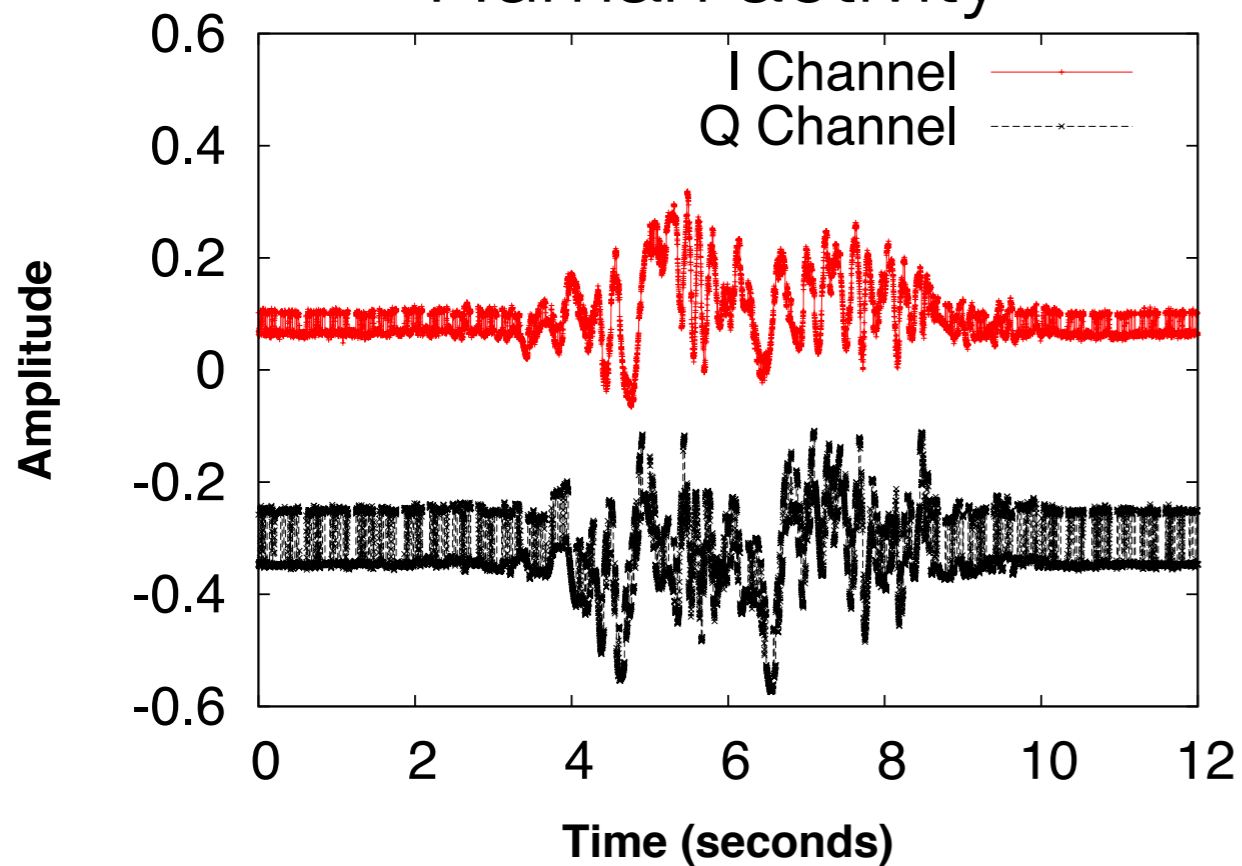
Antenna rotation



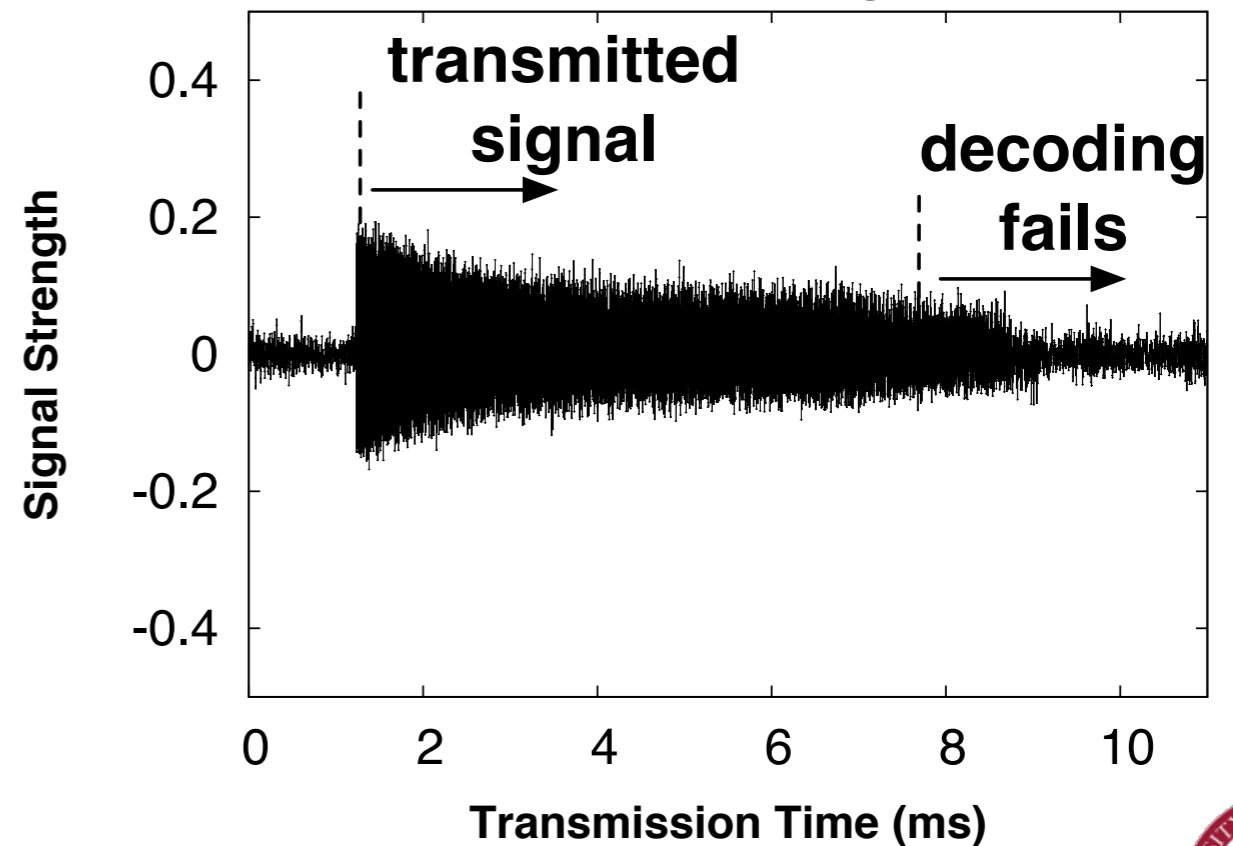
Why is backscatter a challenging domain?



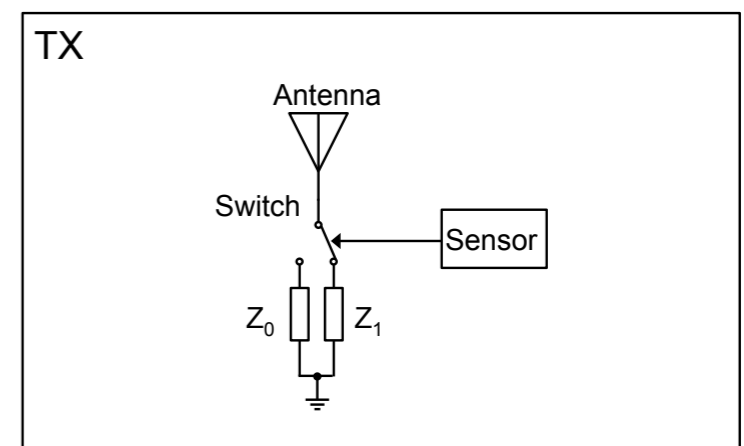
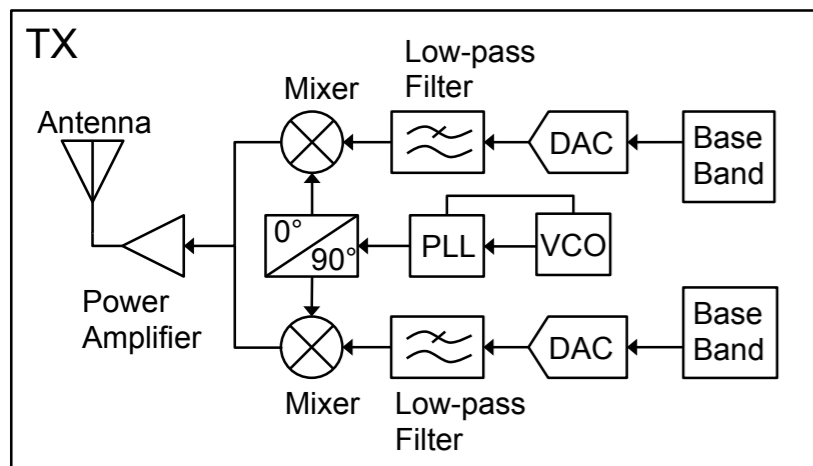
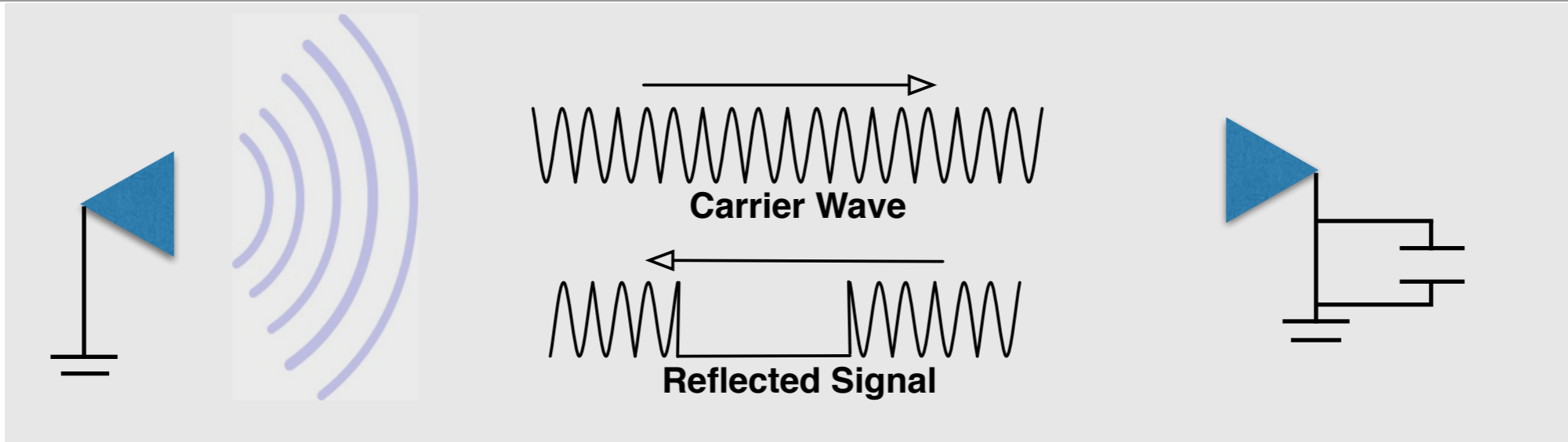
Human activity



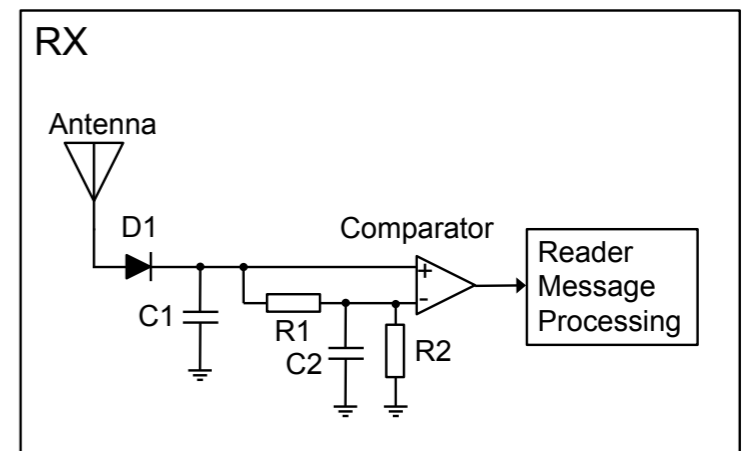
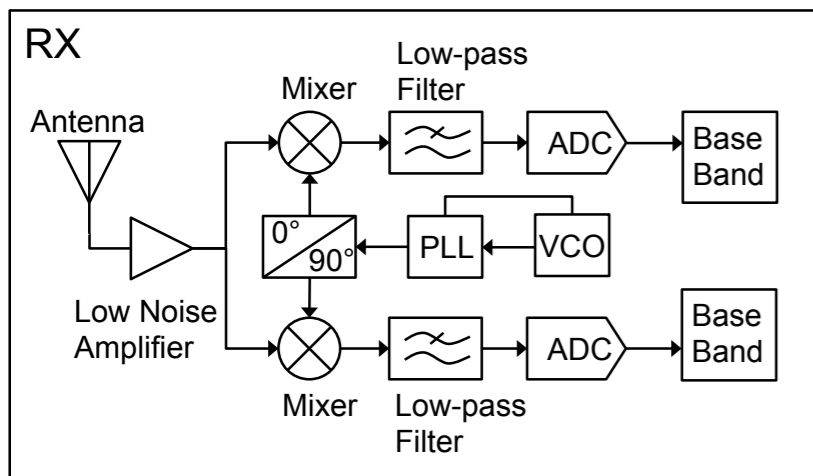
Capacitor charge decay



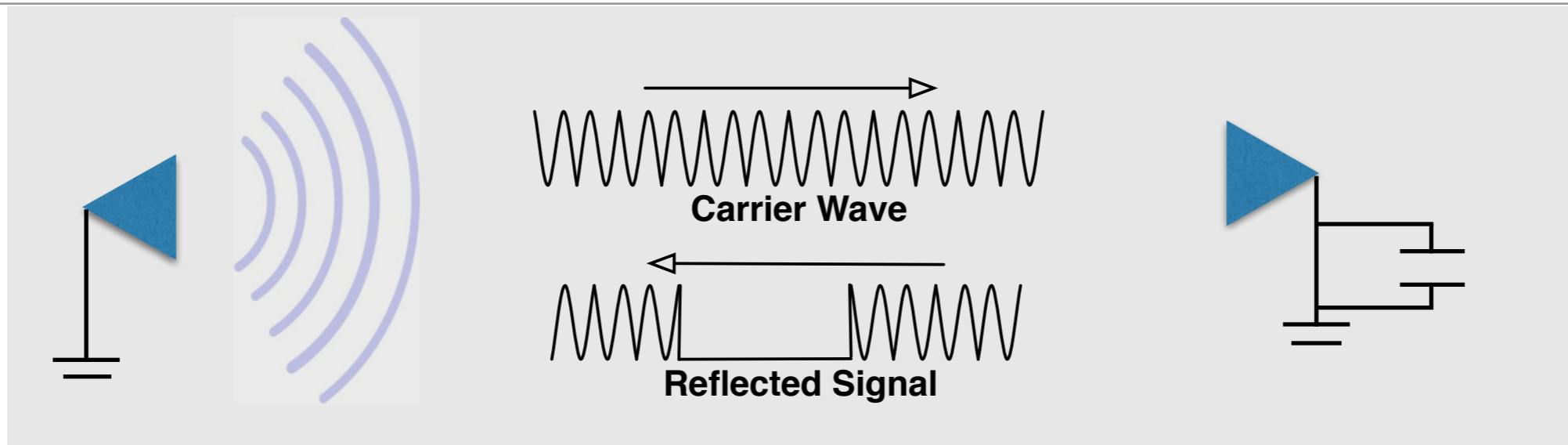
Why is backscatter a challenging domain?



Asymmetry



Why is backscatter a challenging domain?



Power

Range

Throughput

Asymmetry

bit-by-bit
backscatter
[NSDI 2014]

Re-thinking tag
architecture
[Mobicom 2014]

Concurrent
backscatter
[HotWireless 2014]

Hybrid
harvesting
[MobiSys 2012]



Taking stock...

Many promising techniques for solving hard problems in backscatter: range (50 ft), throughput (Mbps), harvesting (Reader/Ambient/WiFi)

Major step is to measure/evaluate/iterate under uncontrolled environments

Case for a backscatter testbed

- Testbed #1: Backscatter-instrumented house
 - Reader/WiFi/Ambient Backscatter for IoT/wearables
- Testbed #2: Backscatter-instrumented human
 - Mobile backscatter reader + “bandaid” sensors
- Why? design complete solutions
 - Robustness in indoor environments
 - Perpetual link while user is mobile



Thank you

