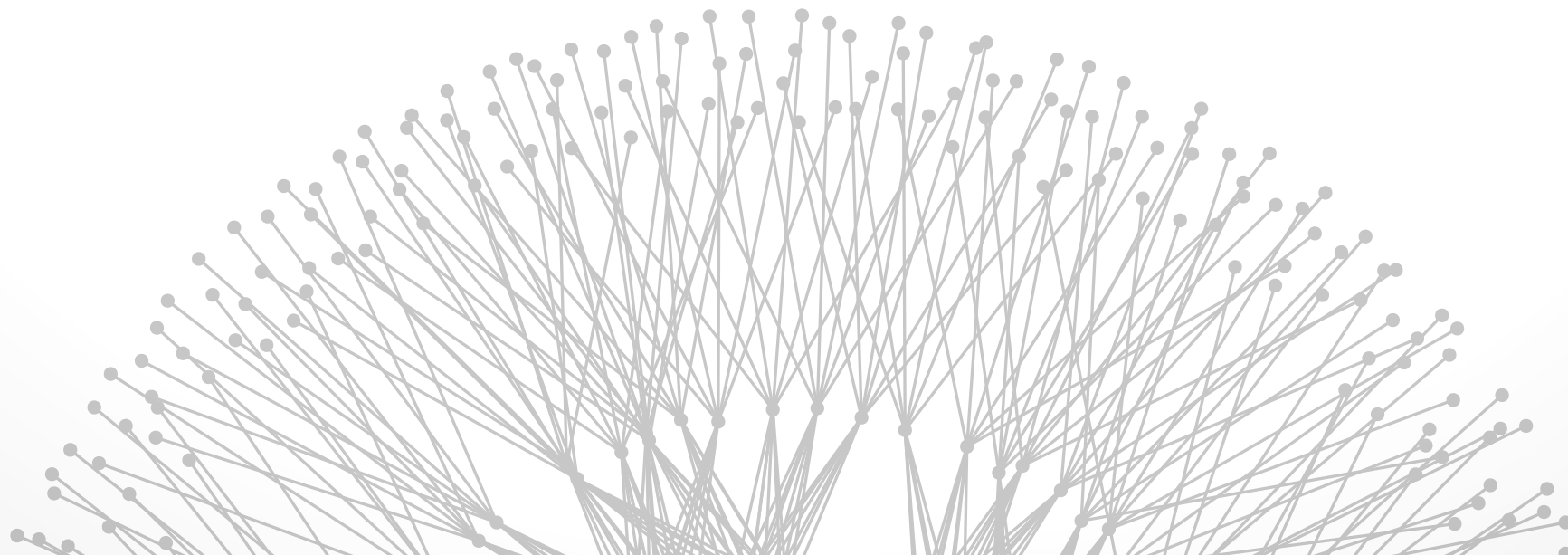


# Wireless networking

Brighten Godfrey  
CS 538 November 17 2011



# Challenges of wireless



## Shared, exposed medium

### Interference

- from other users
- from same user! (multipath)
- from external environment

### Signal attenuation (path loss)

### Dynamic & unknown physical medium

### Security

# Wireless at HotNets



## 3D Beamforming for Wireless Data Centers

Weile Zhang (UCSB & Xian Jiaotong U.), Xia Zhou (UCSB), Lei Yang (Intel Labs), Zengbin Zhang (UCSB), Ben Y. Zhao and Haitao Zheng (UCSB)

## Bootstrapping Energy Debugging on Smartphones: A First Look at Energy Bugs in Mobile Devices

Abhinav Pathak and Y. Charlie Hu (Purdue University) and Ming Zhang (Microsoft Research)

## Rateless Spinal Codes

Jonathan Perry, Hari Balakrishnan, and Devavrat Shah (MIT)

## Picasso: Programmable Signal Shaping to Exploit Fragmented Spectrum

Steven Hong, Jeff Mehlman, and Sachin Katti (Stanford University)

## The Case for Antenna Cancellation for Scalable Full Duplex Wireless Communications

Mohammad A. Khojastepour, Karthikeyan Sundaresan, and Sampath Rangarajan (NEC Labs America), Xinyu Zhang (Univ. Of Michigan), and Sanaz Barghi (Univ of California, Irvine)

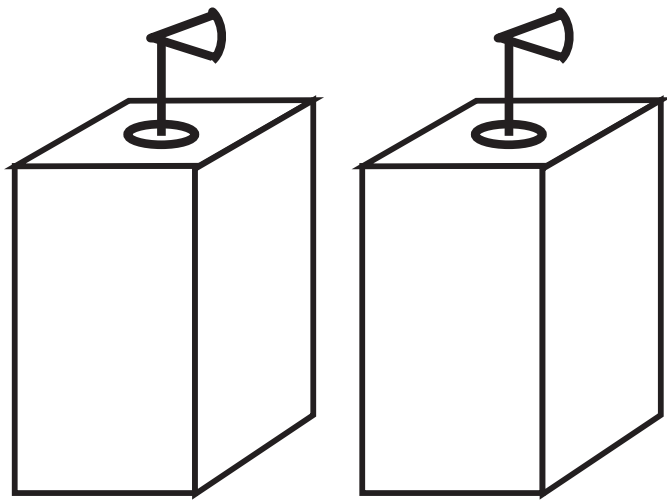
## Precise Indoor Localization using PHY Layer Information

Souvik Sen (Duke University), Bozidar Radunovic (Microsoft Research), Romit Roy Choudhury (Duke University), and Tom Minka (Microsoft Research)

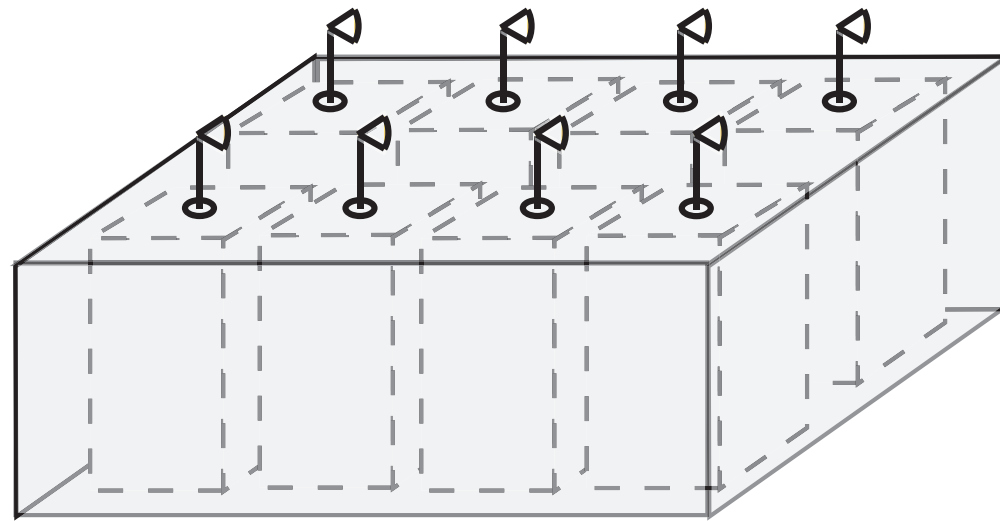
# 3D Beamforming



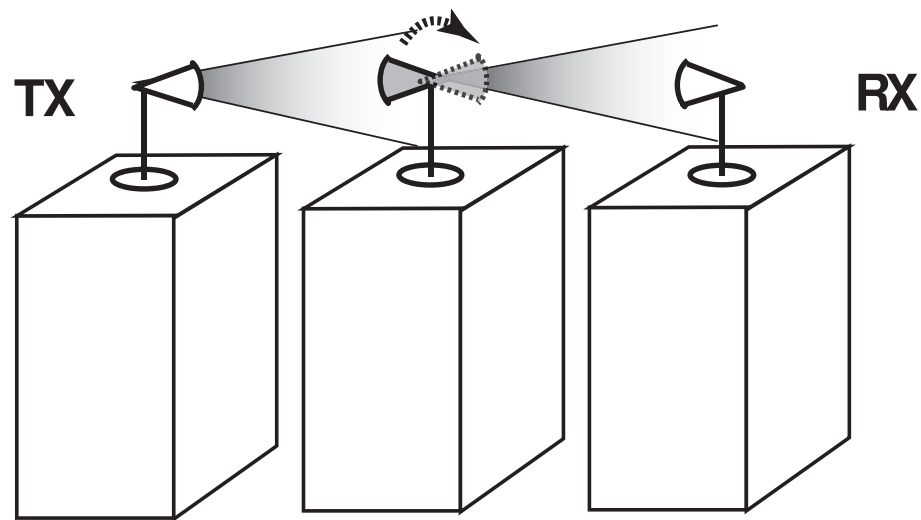
[Zhang et al.]



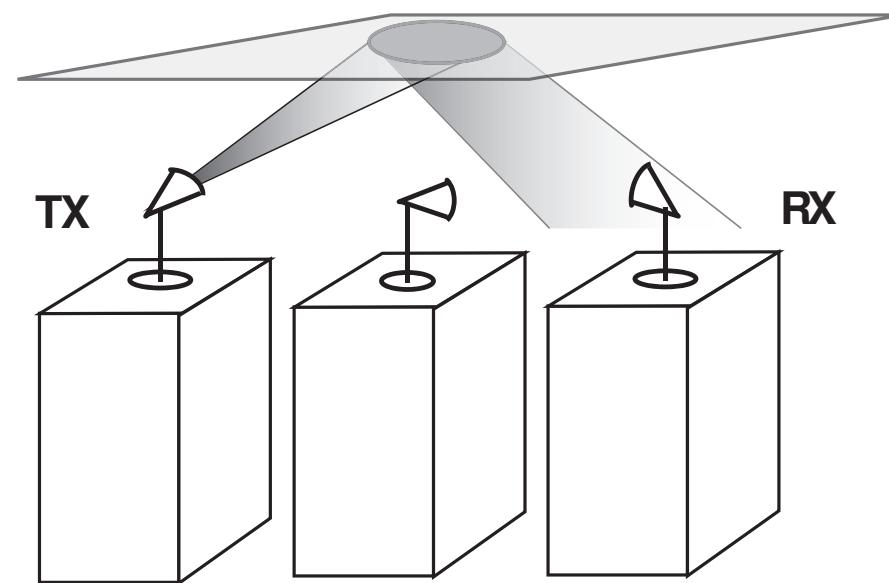
(a) Rack-based DC



(b) Container-based DC

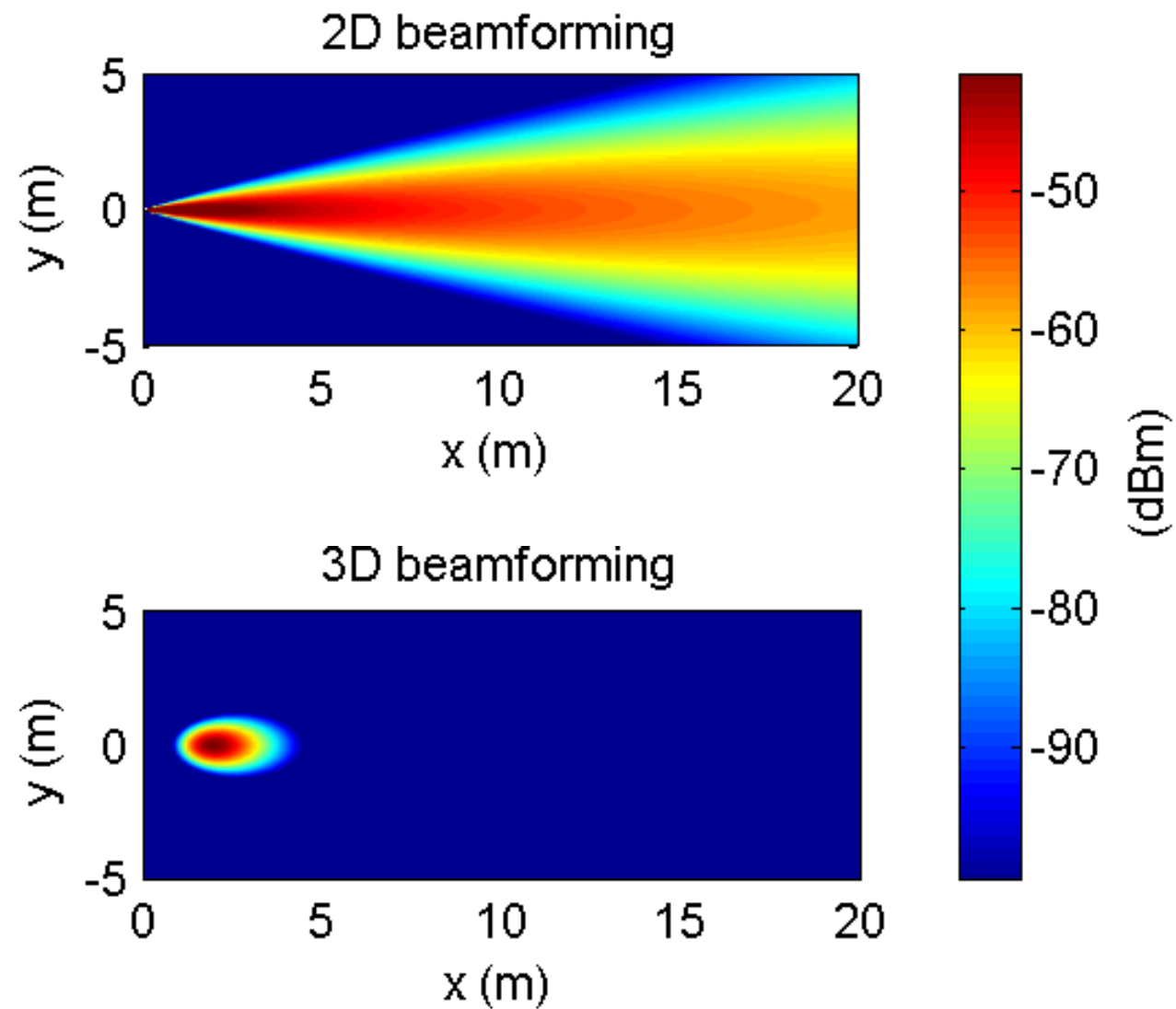


(c) 2D Beamforming

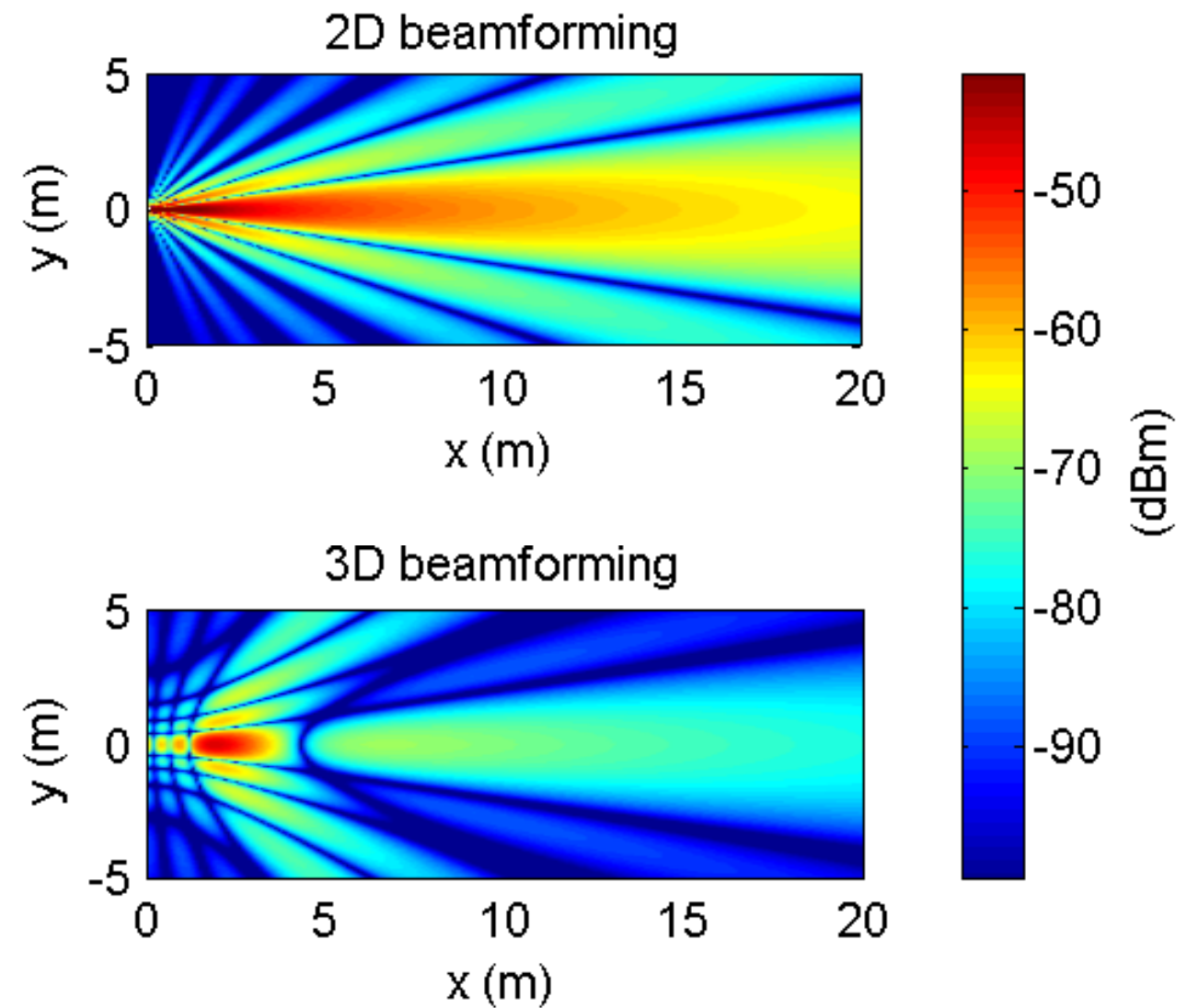


(d) 3D Beamforming

# 3D Beamforming



(b) Interference region, horn antenna



(c) Interference region, antenna array

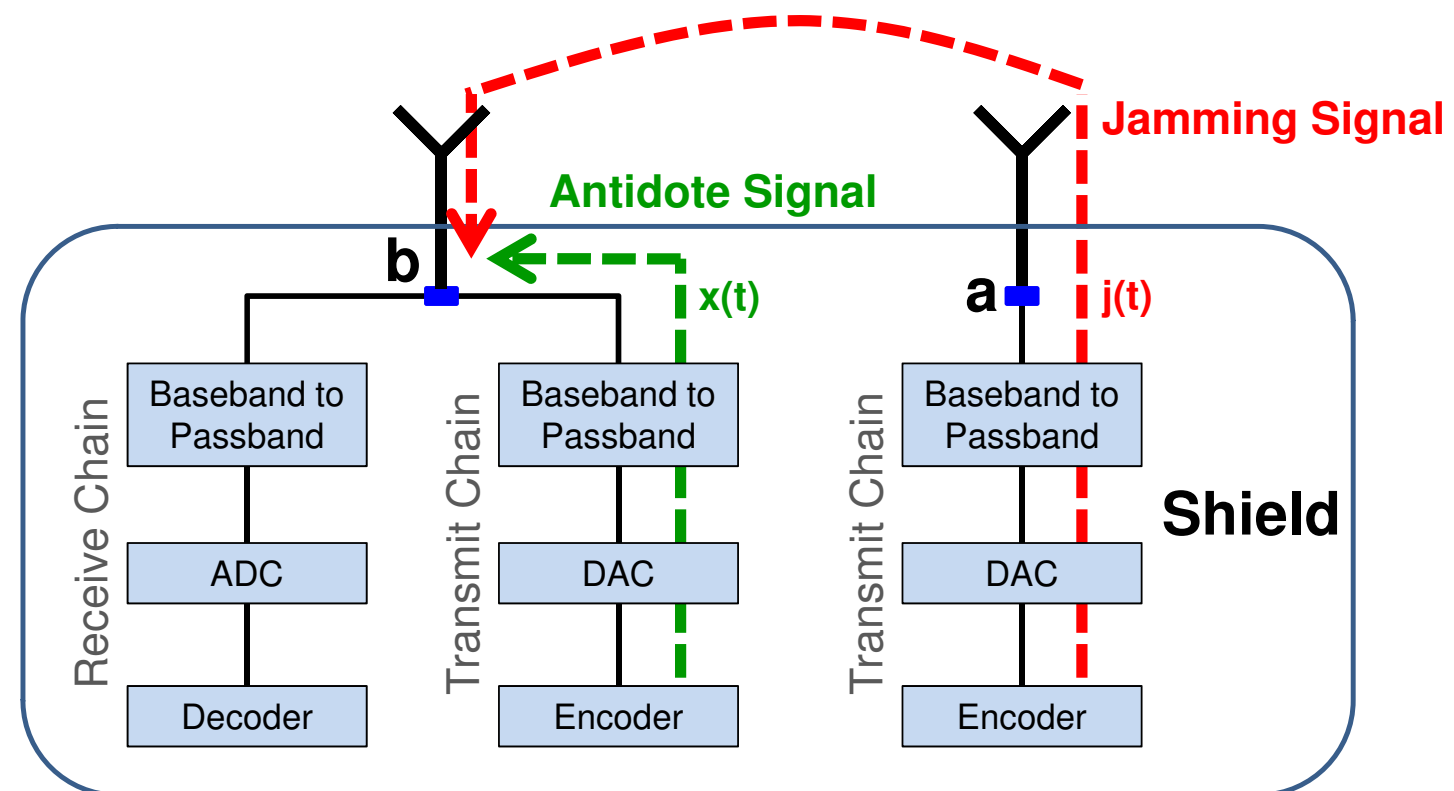
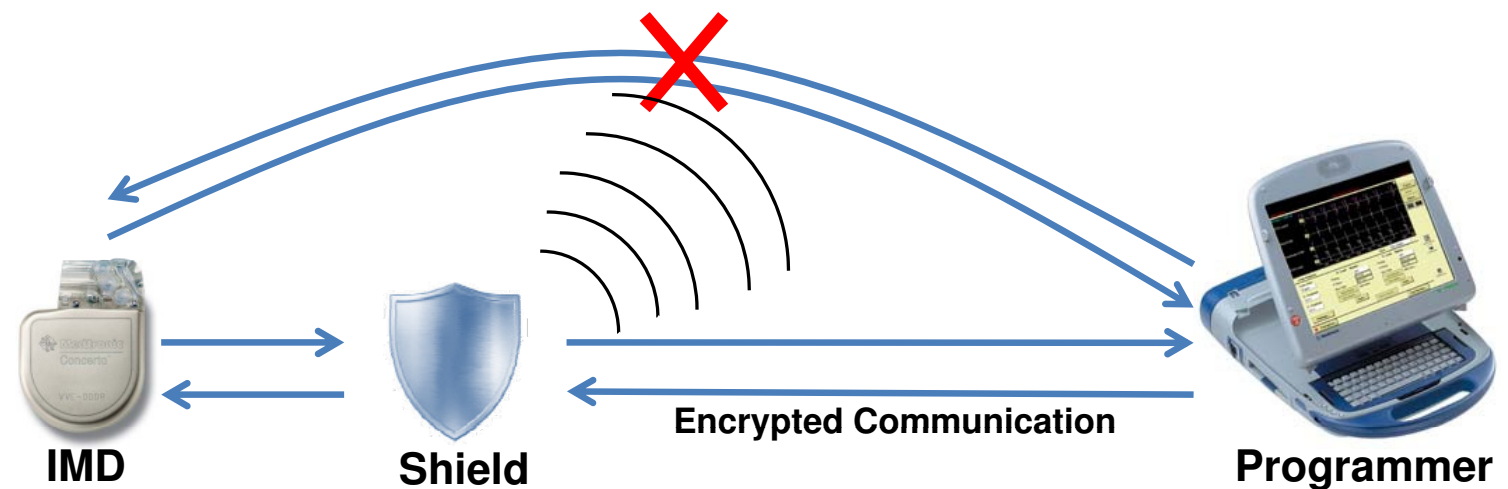
# They Can Hear Your Heartbeats



[Gollakota, Hassanieh,  
Ransford, Katabi, Fu,  
SIGCOMM'11]

## Key contributions

- Secure an insecure device without modification
- *Small* full-duplex radio



# Announcements



Homework due 11:59 p.m. tonight

Happy Thanksgiving!