

# Device-Free Indoor Localization Using Ambient Radio Signals

Andrei Popleteev

*SnT, University of Luxembourg*

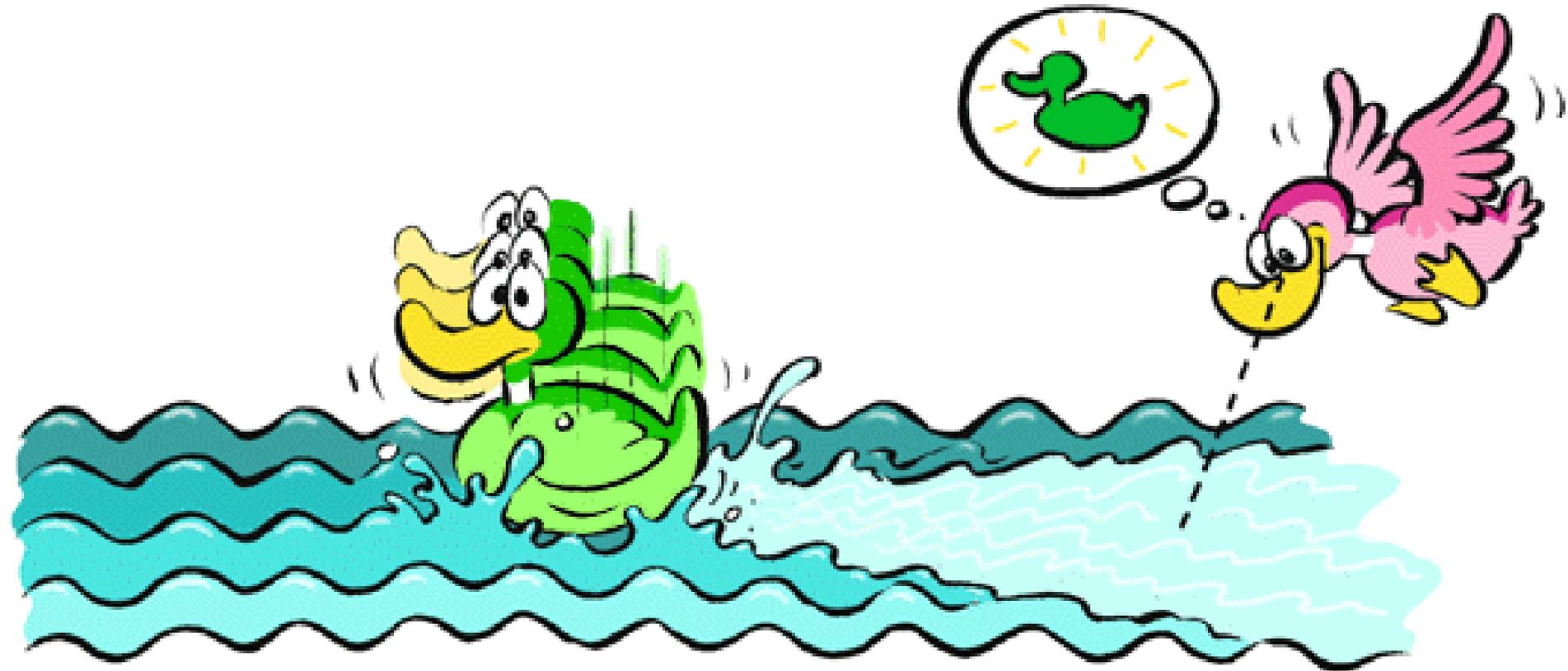


**Device-based positioning**



**Localizing cows for 4000 years**

# Device-free sensing

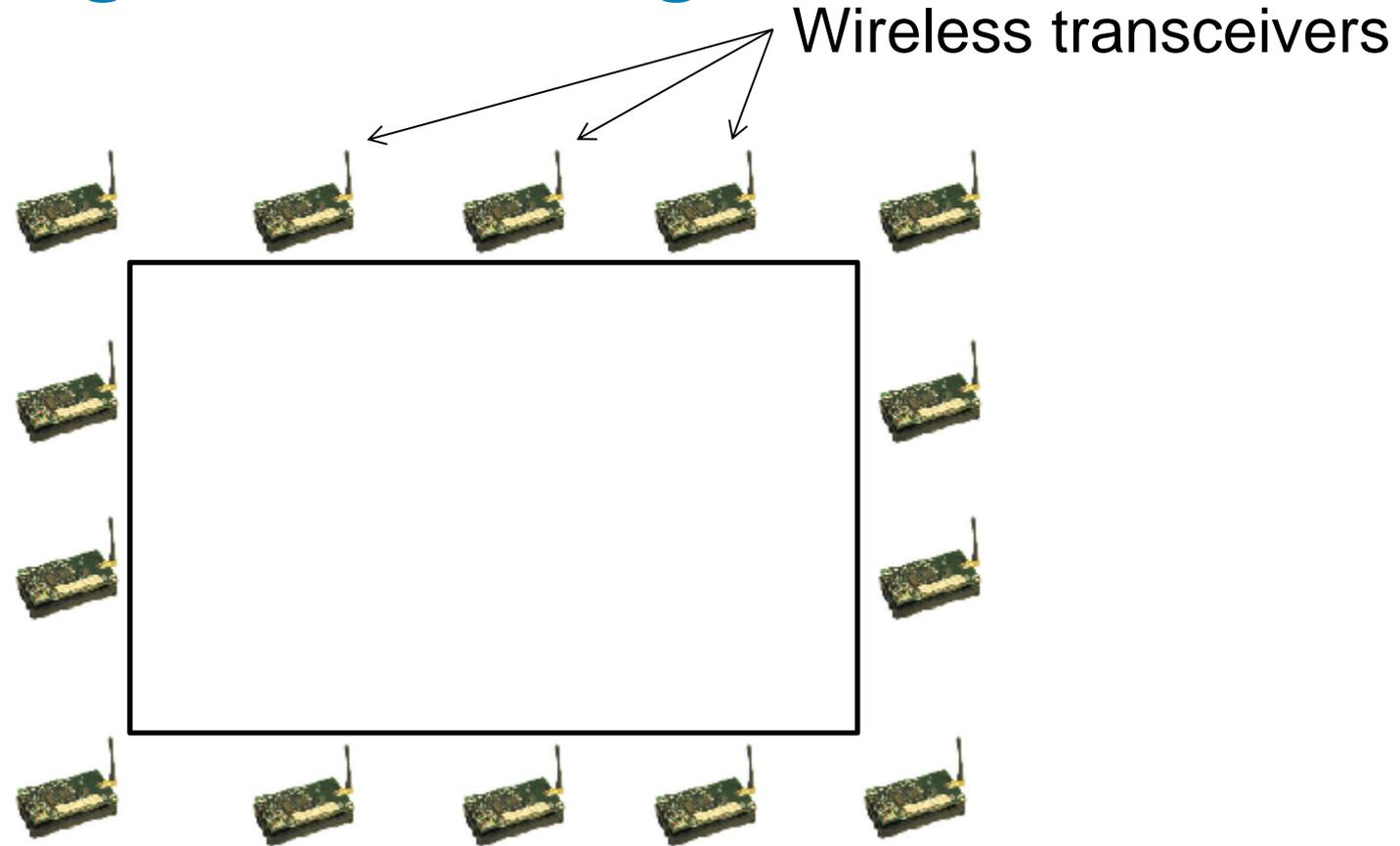


# Device-free sensing

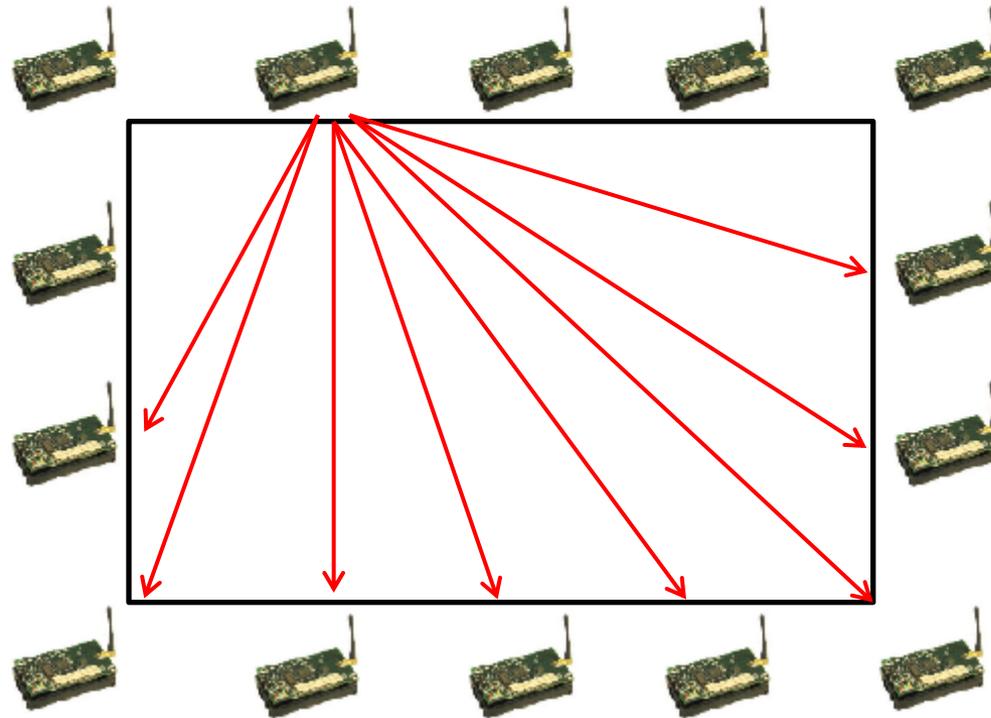
- User freedom
  - Nothing to carry
- Research freedom
  - More computational resources at hand
  - Unlimited grid power, not battery
  - More antennas



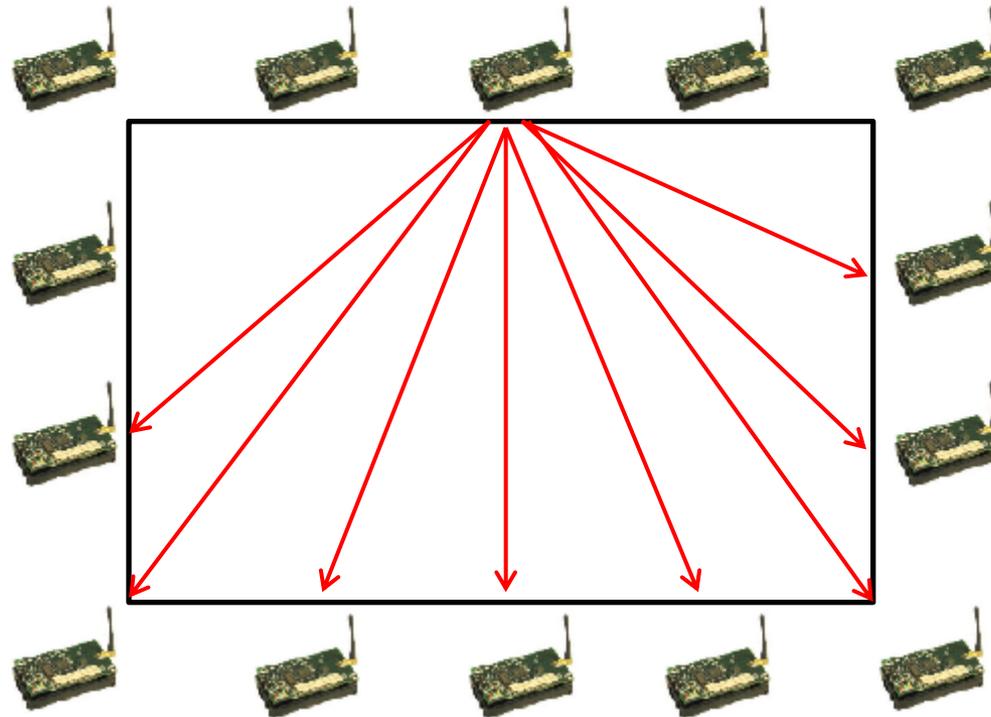
# State of the art: Line-of-sight shadowing



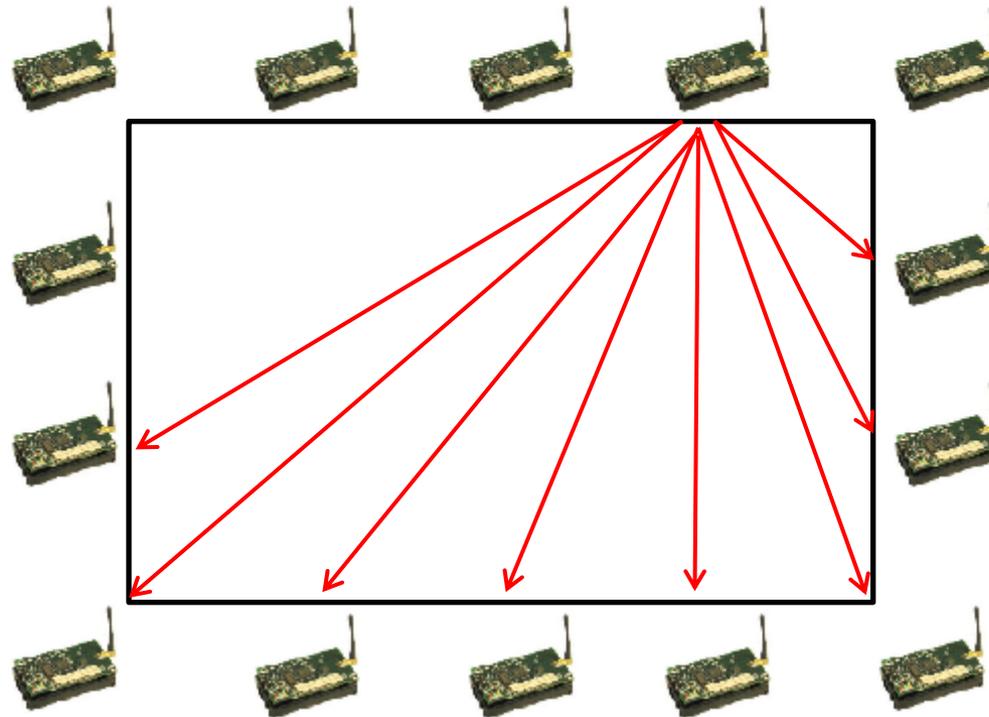
# State of the art: Line-of-sight shadowing



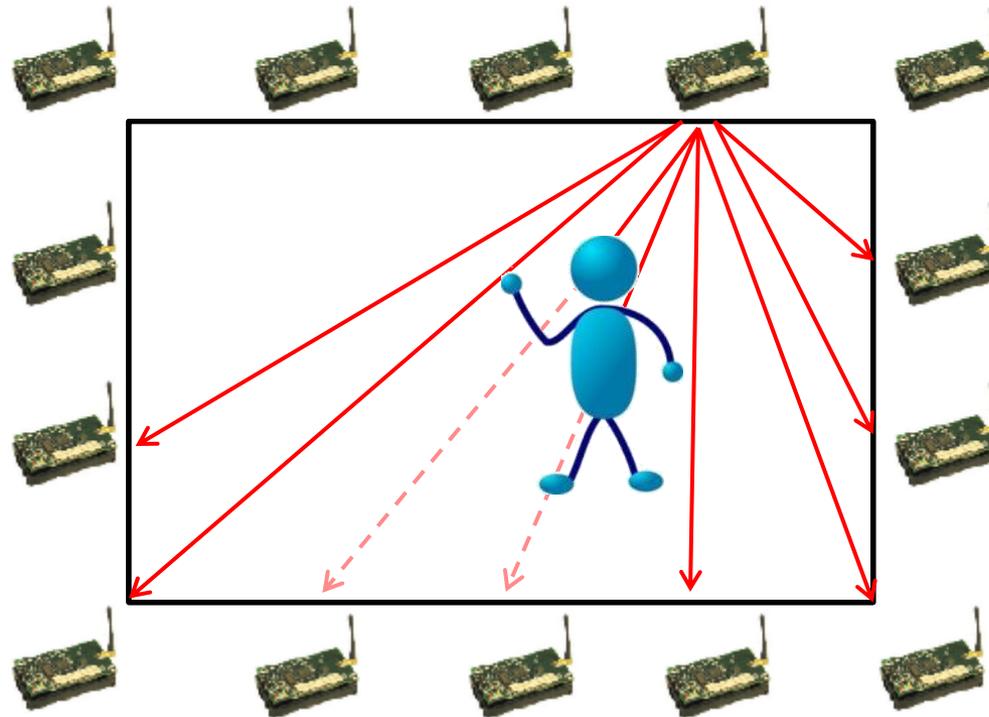
# State of the art: Line-of-sight shadowing



# State of the art: Line-of-sight shadowing



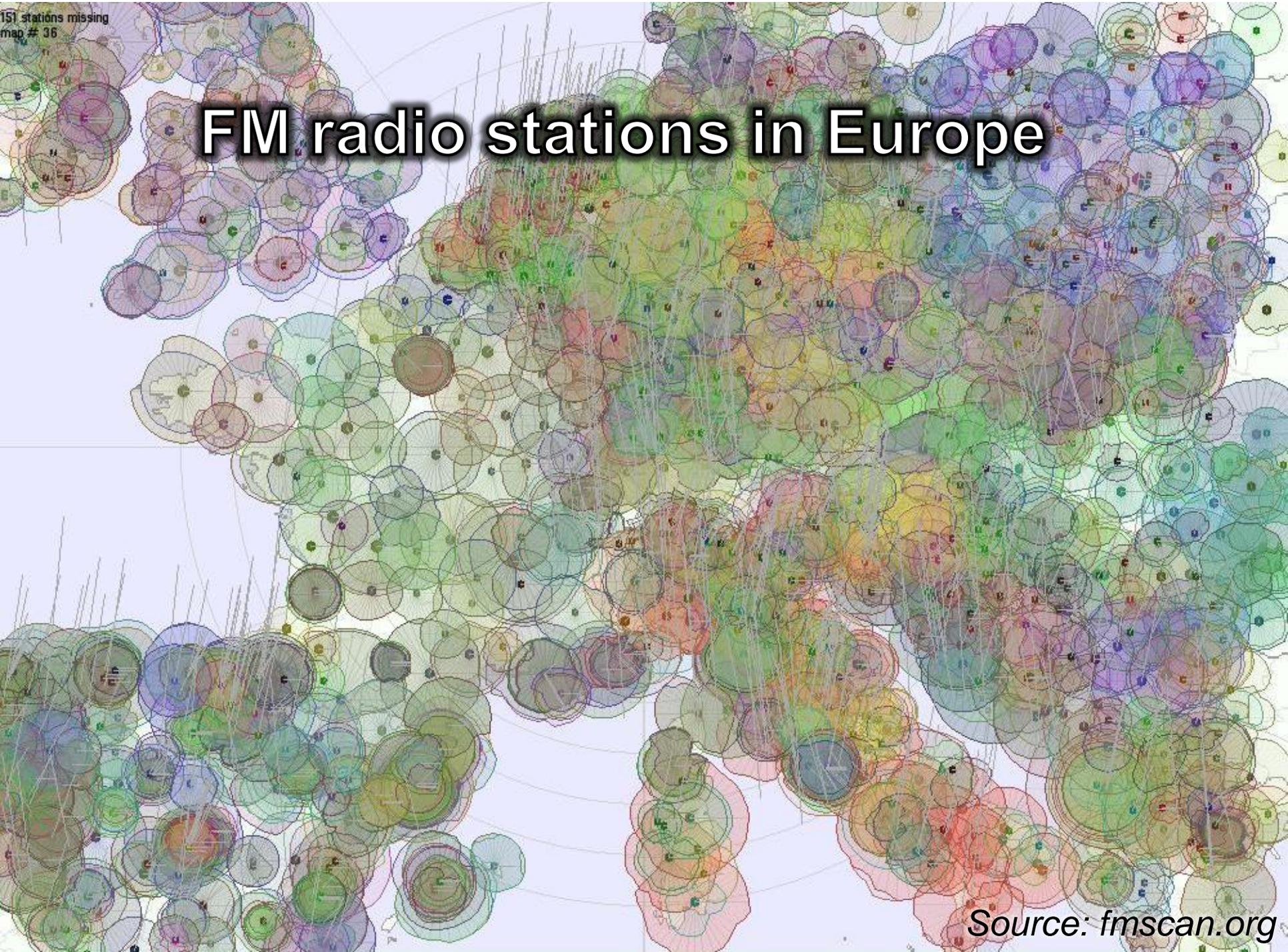
# State of the art: Line-of-sight shadowing



A top-down view of 25 green printed circuit boards (PCBs) arranged in a 5x5 grid on a light-colored surface. Each board is populated with various electronic components, including integrated circuits, resistors, and capacitors. Red and blue wires connect the boards in a mesh pattern, with some wires crossing between adjacent boards. The boards are illuminated, and some have small red and blue LEDs lit. The text "Too many devices!" is overlaid in the center in a large, white, bold, sans-serif font.

**Too many  
devices!**

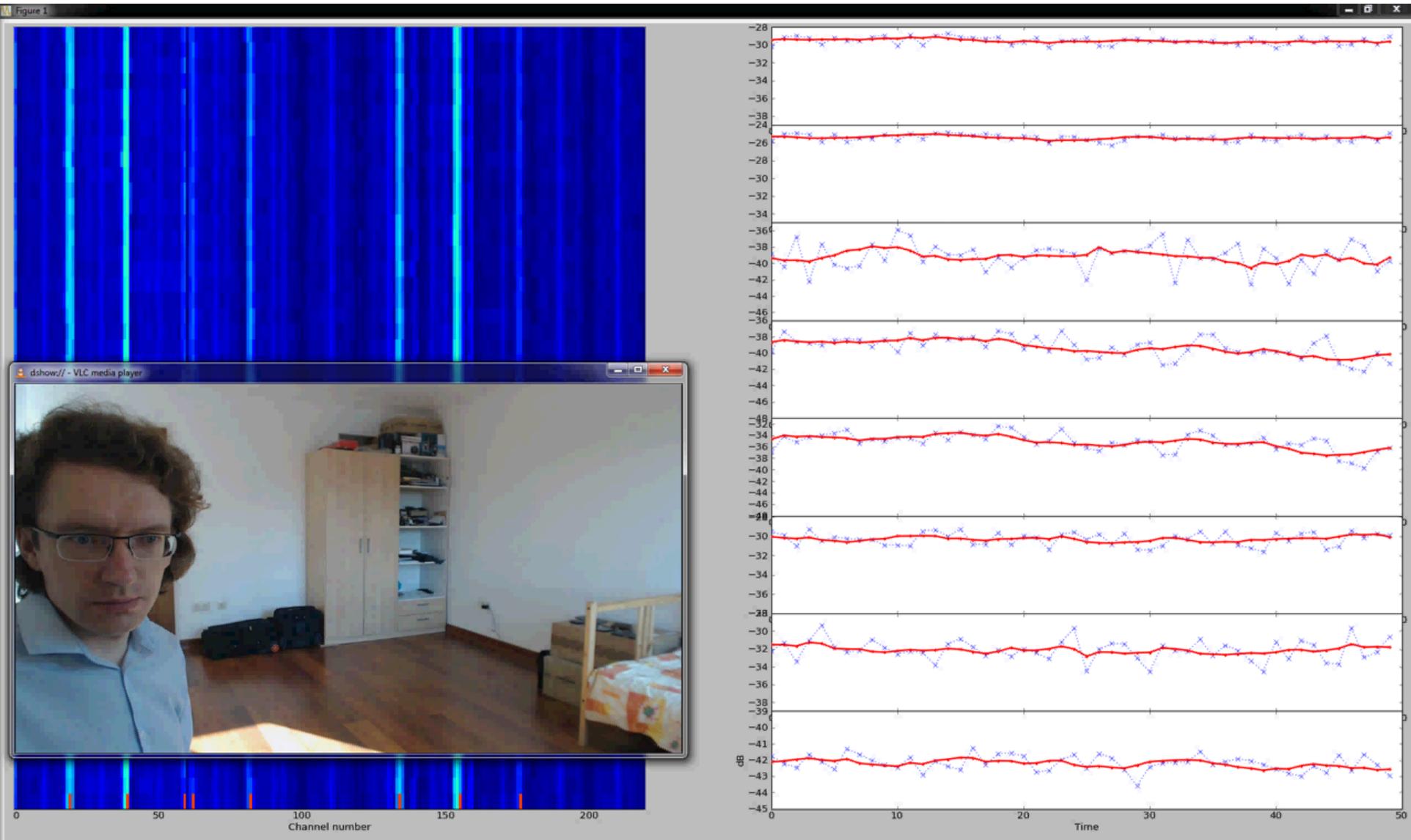
# FM radio stations in Europe



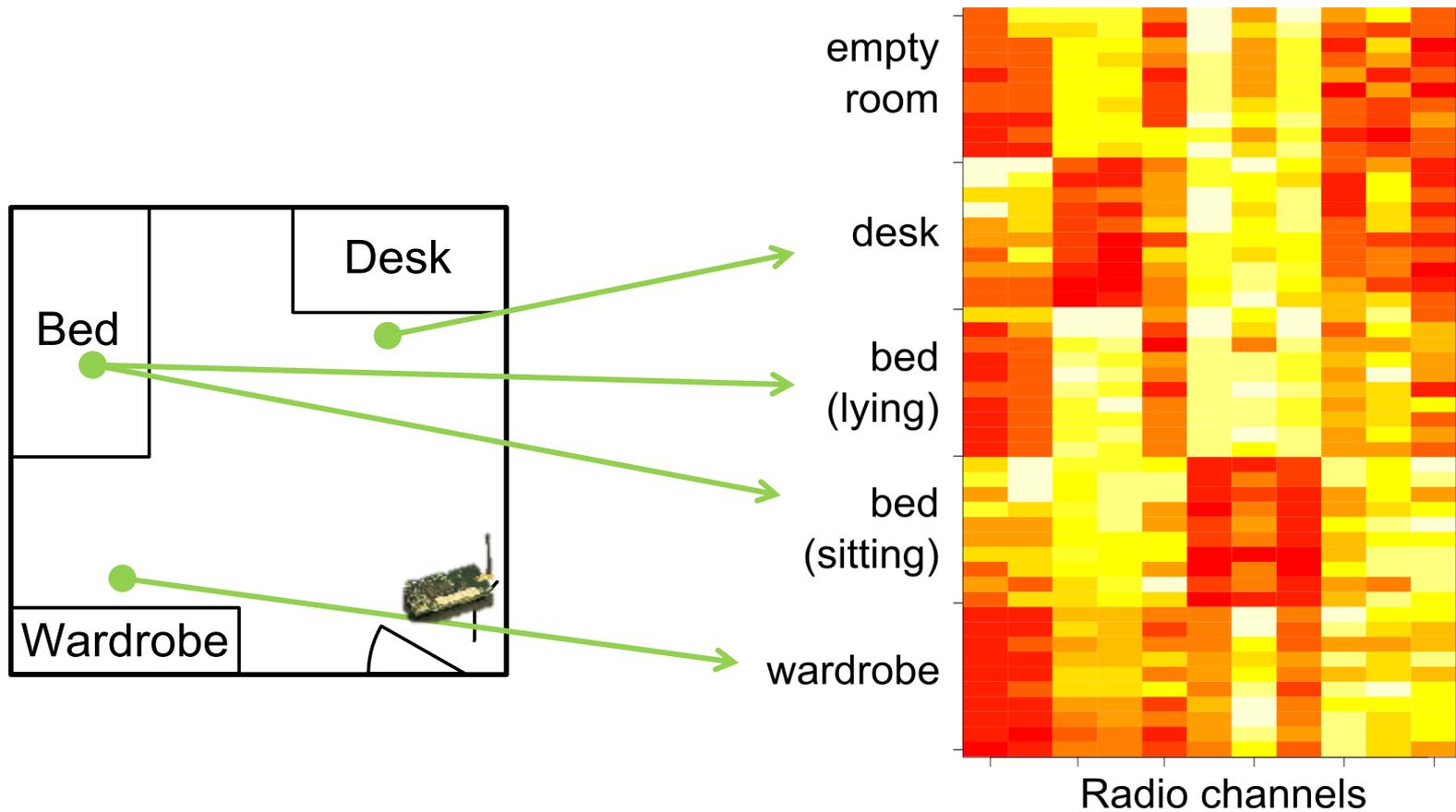
# Ambient radio sensing



# Proof of the concept (video)



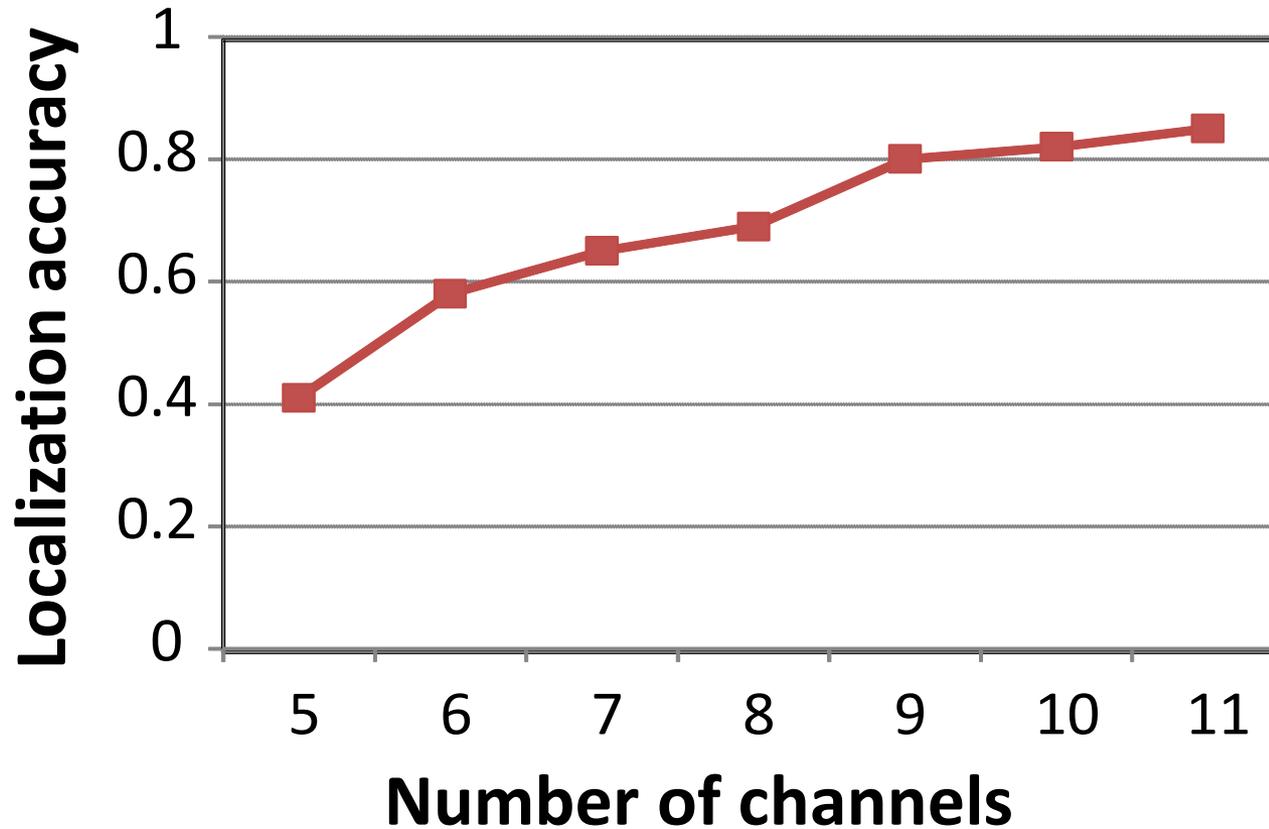
# Sample dataset



# Localization performance

- 4 days, 2 datasets daily
- 85% same-day accuracy
- 65% three days later  
*(still better than 20% of random guess)*

# The more stations – the better



# Summary

- Device-free localization with ambient radio is feasible
- Frequency diversity is essential

# Thank you!

