

# A Novel Approach of Passive Localization for Indoor Positioning

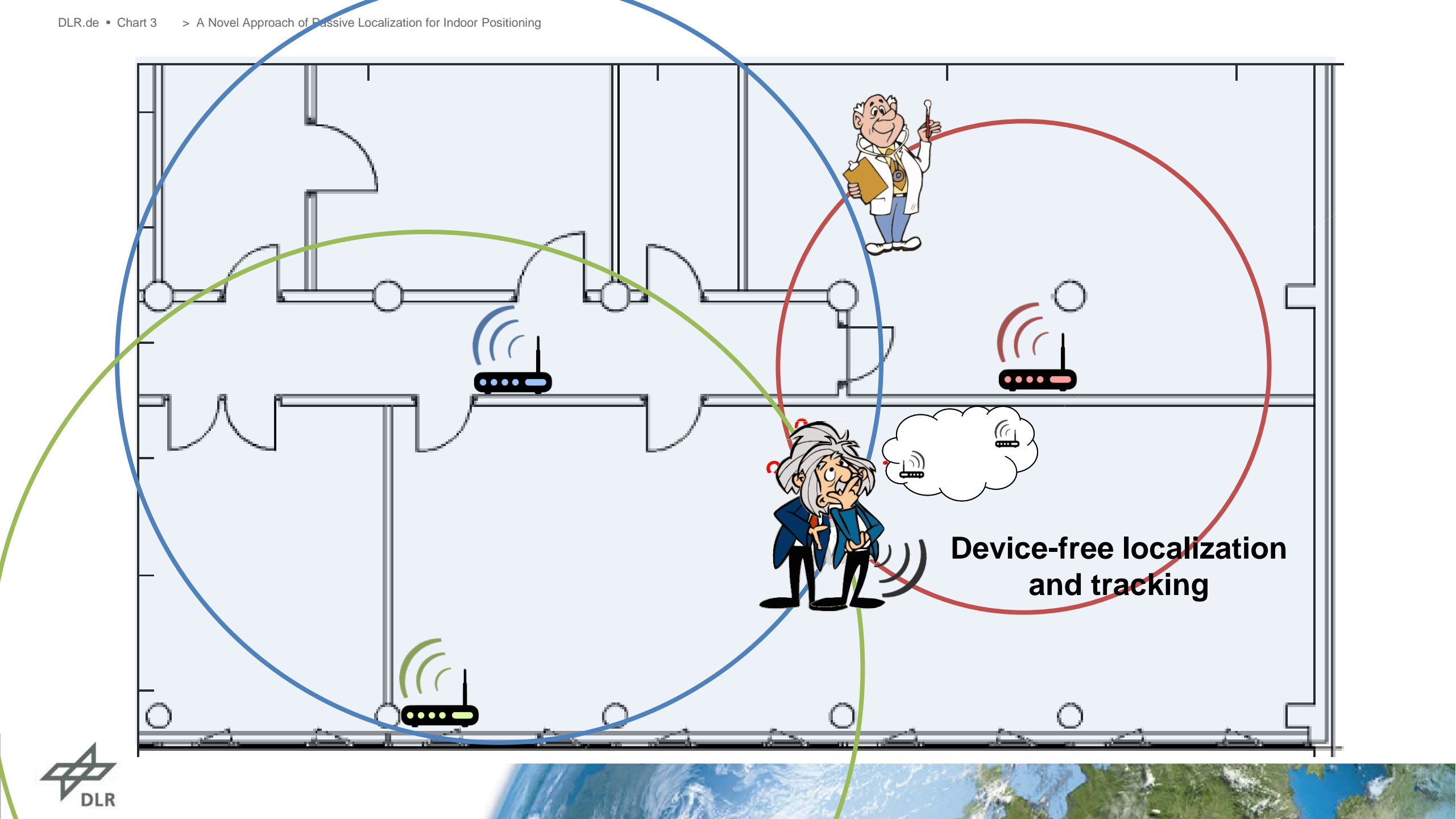
Martin Schmidhammer and Christian Gentner



Knowledge for Tomorrow

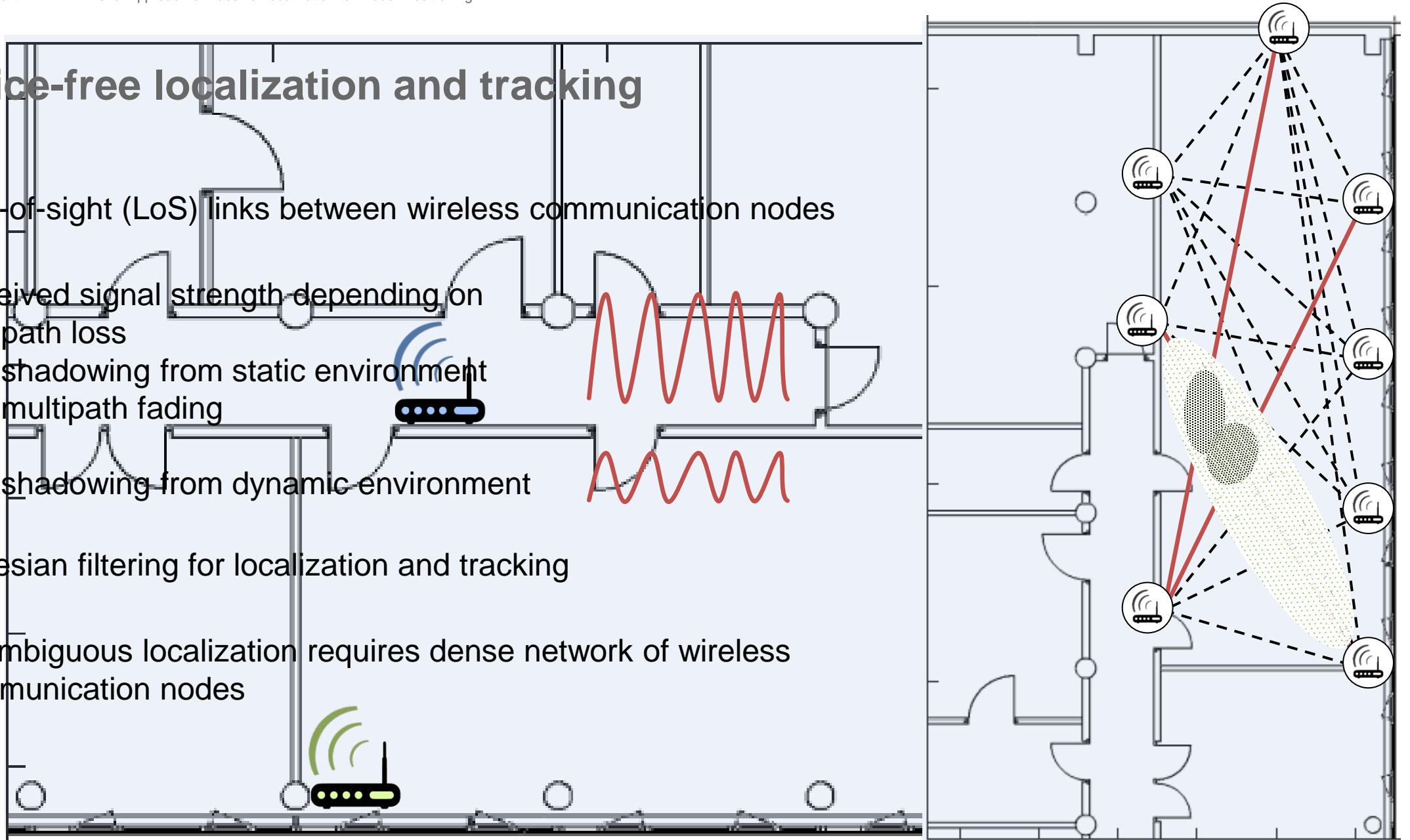






## Device-free localization and tracking

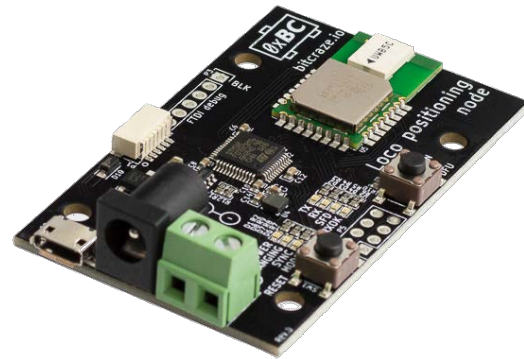
- Line-of-sight (LoS) links between wireless communication nodes
- Received signal strength depending on
  - path loss
  - shadowing from static environment
  - multipath fading
  - shadowing from dynamic environment
- Bayesian filtering for localization and tracking
- Unambiguous localization requires dense network of wireless communication nodes



# Device-free localization and tracking

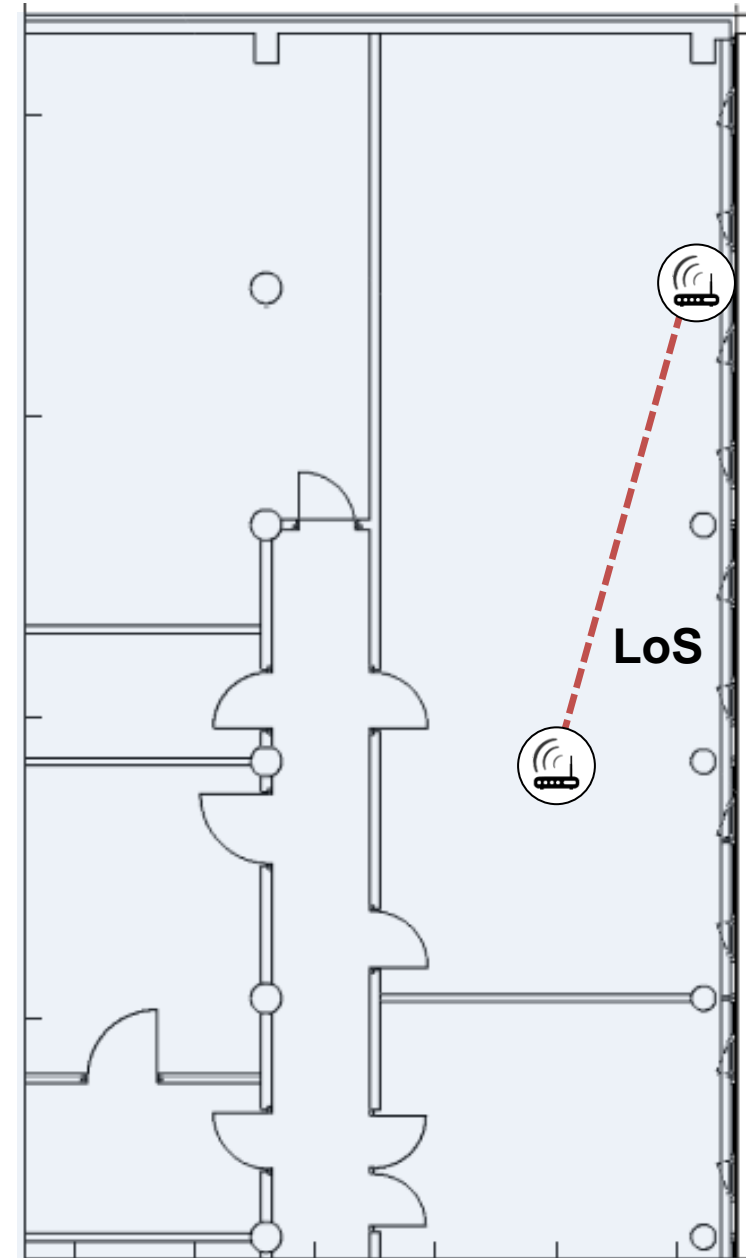
## Direct links only!?

Measurement hardware



*decaWave DWM1000 chip*

- IEEE 802.15.4-2011 UltraWideband compliant
- 500 MHz bandwidth
- Low-cost transceiver
- Low-power consumption
- Channel impulse response (CIR) accessible

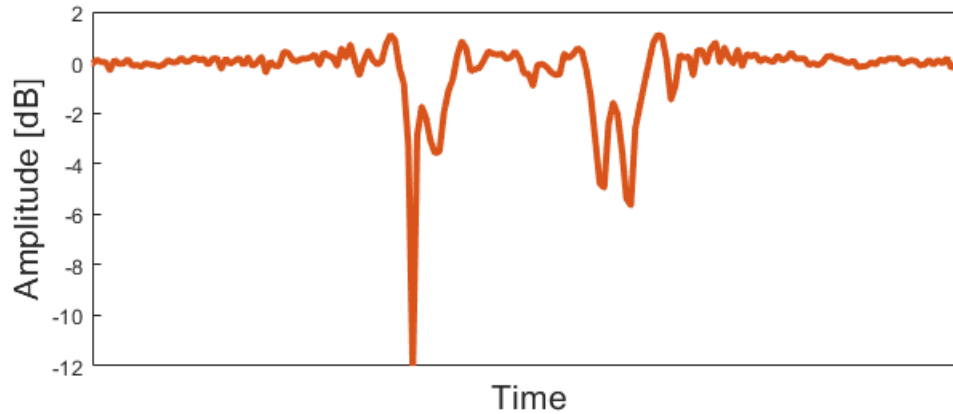


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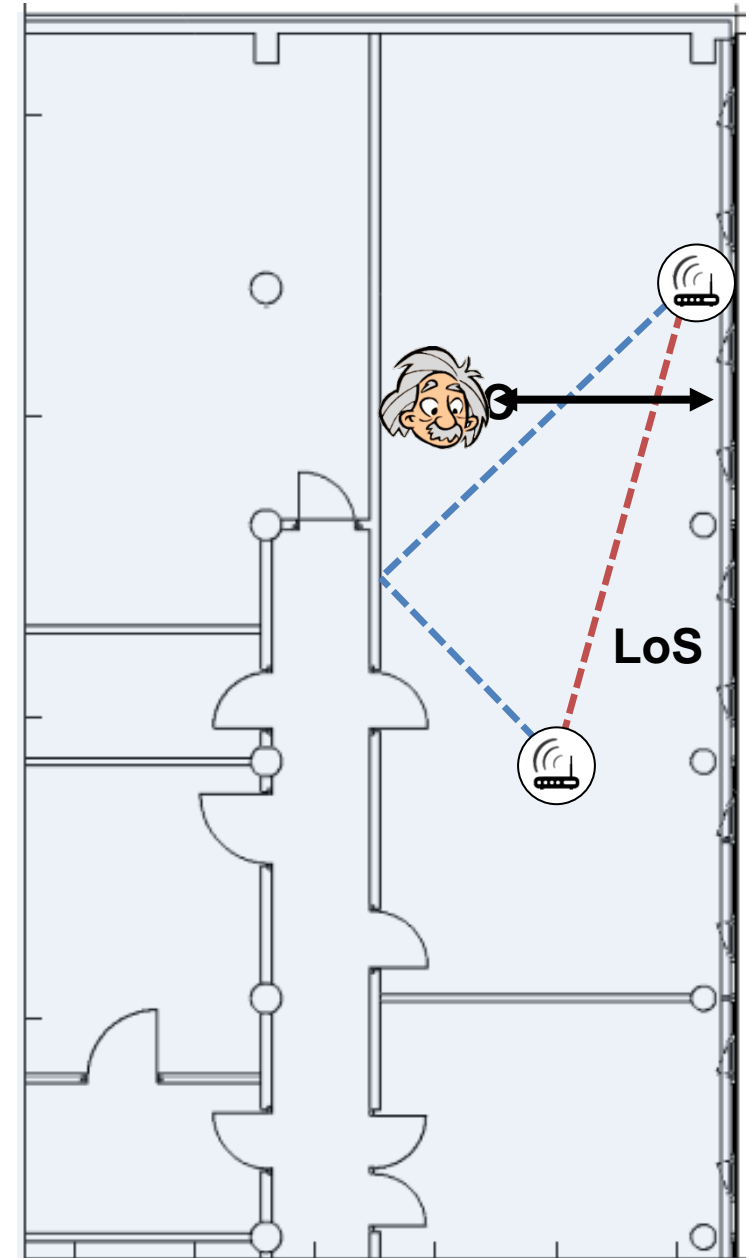
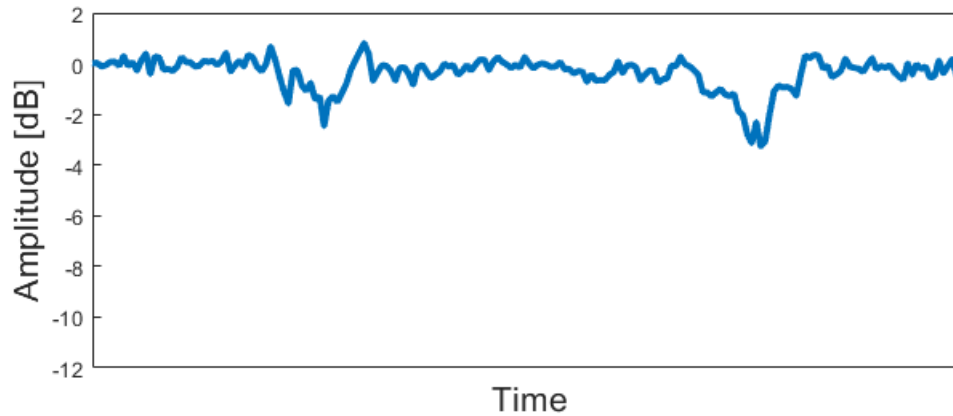
## Direct links only!?

Static multipath components (MPC) from reflection and scattering

LoS link



MPC link

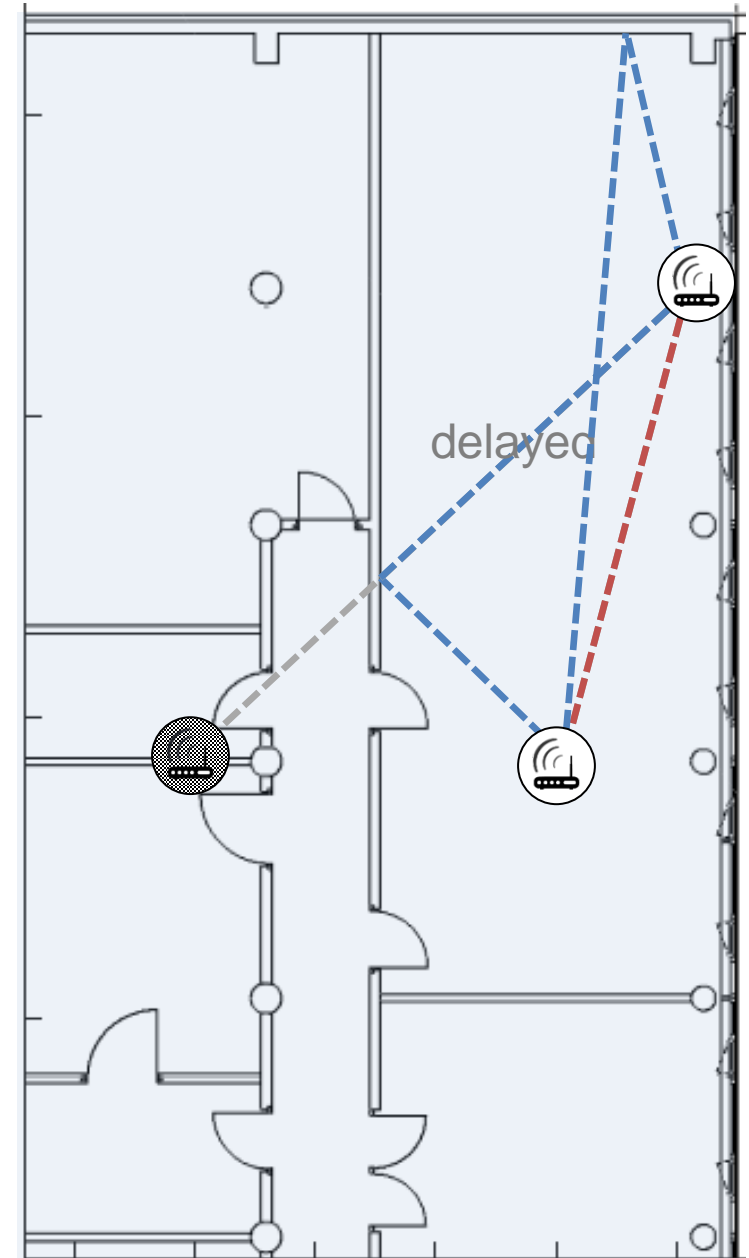
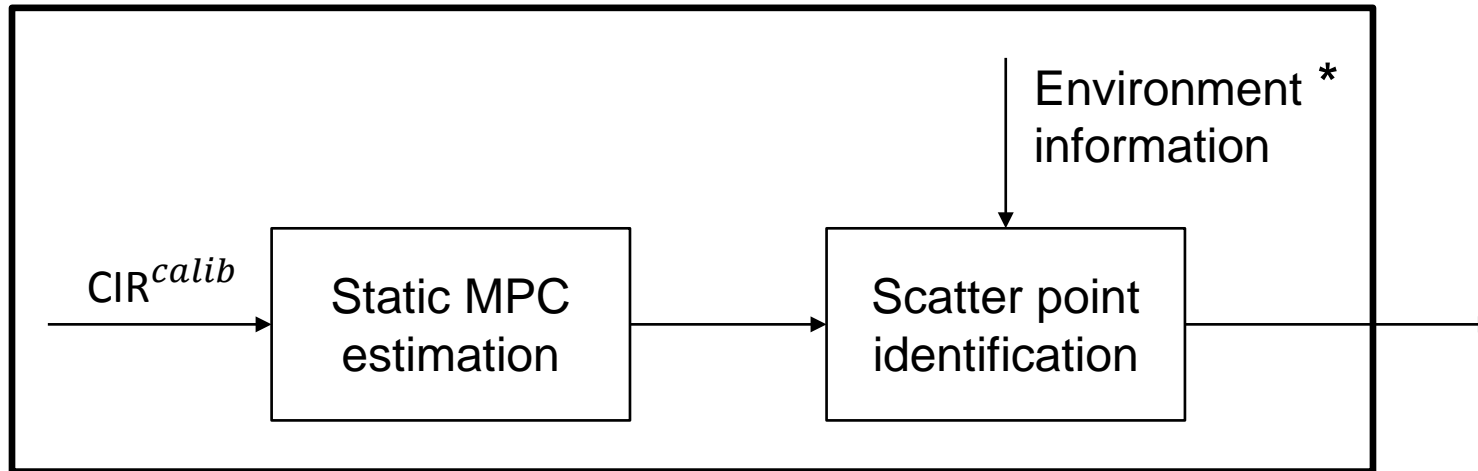


# Device-free localization and tracking

## Multipath-enhanced!

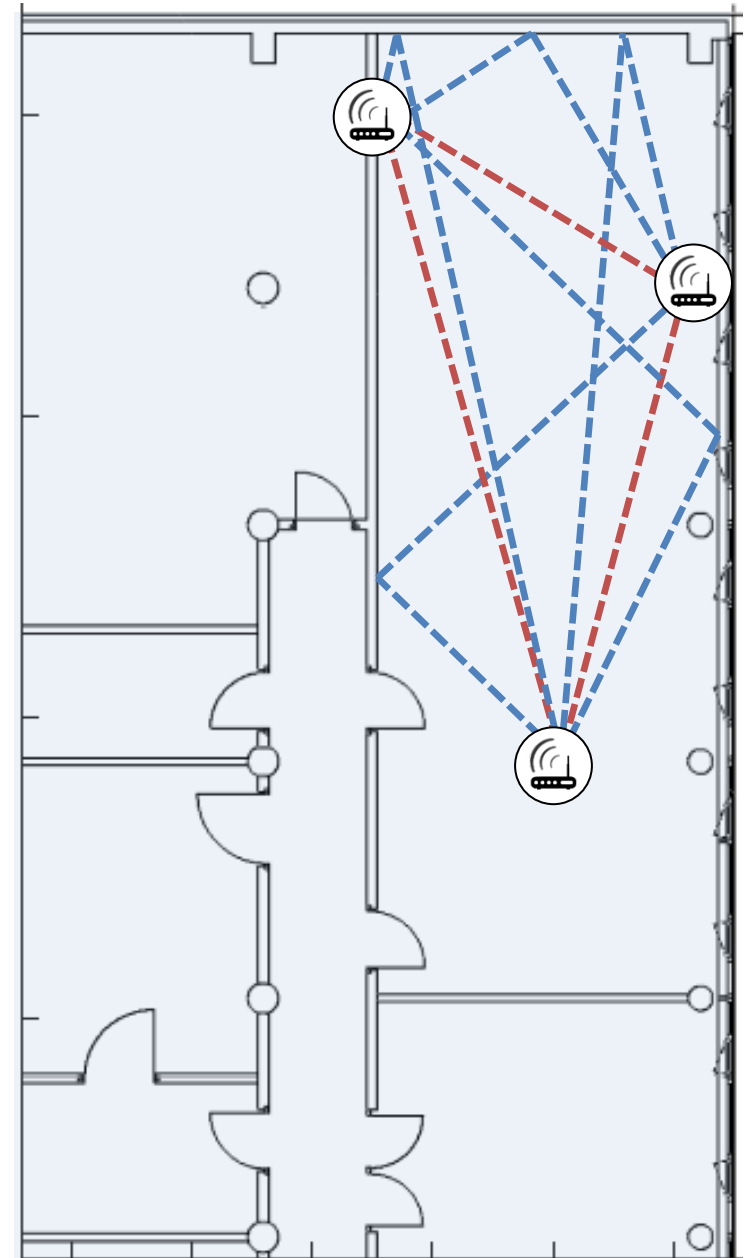
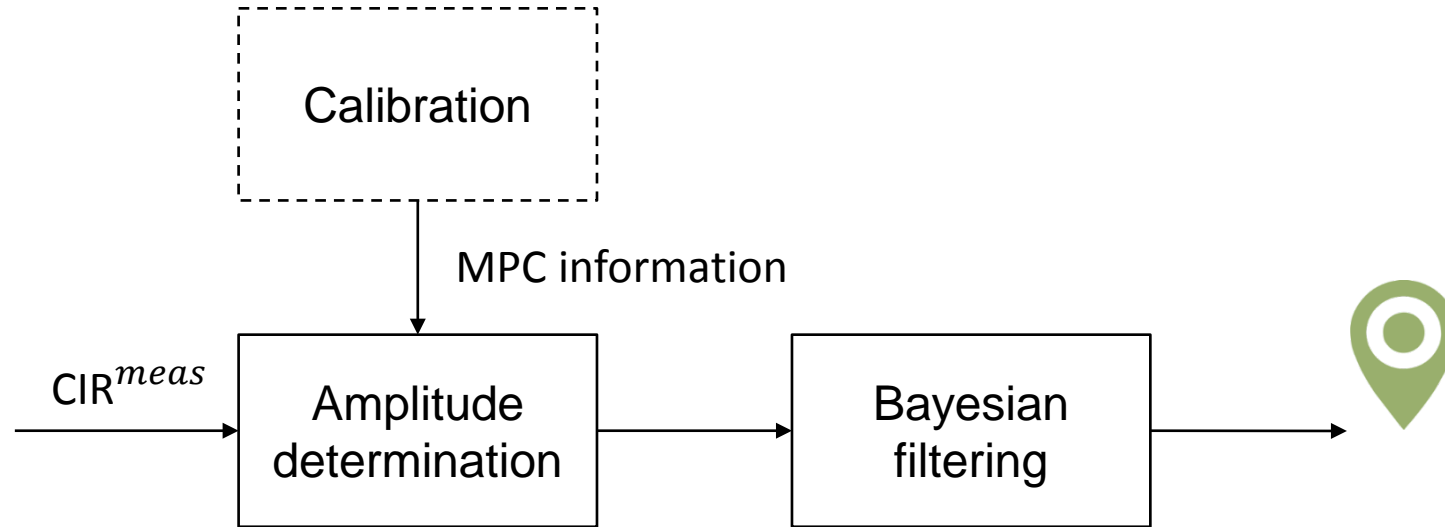
Preprocessing for each pair of transmitter and receiver

### Calibration



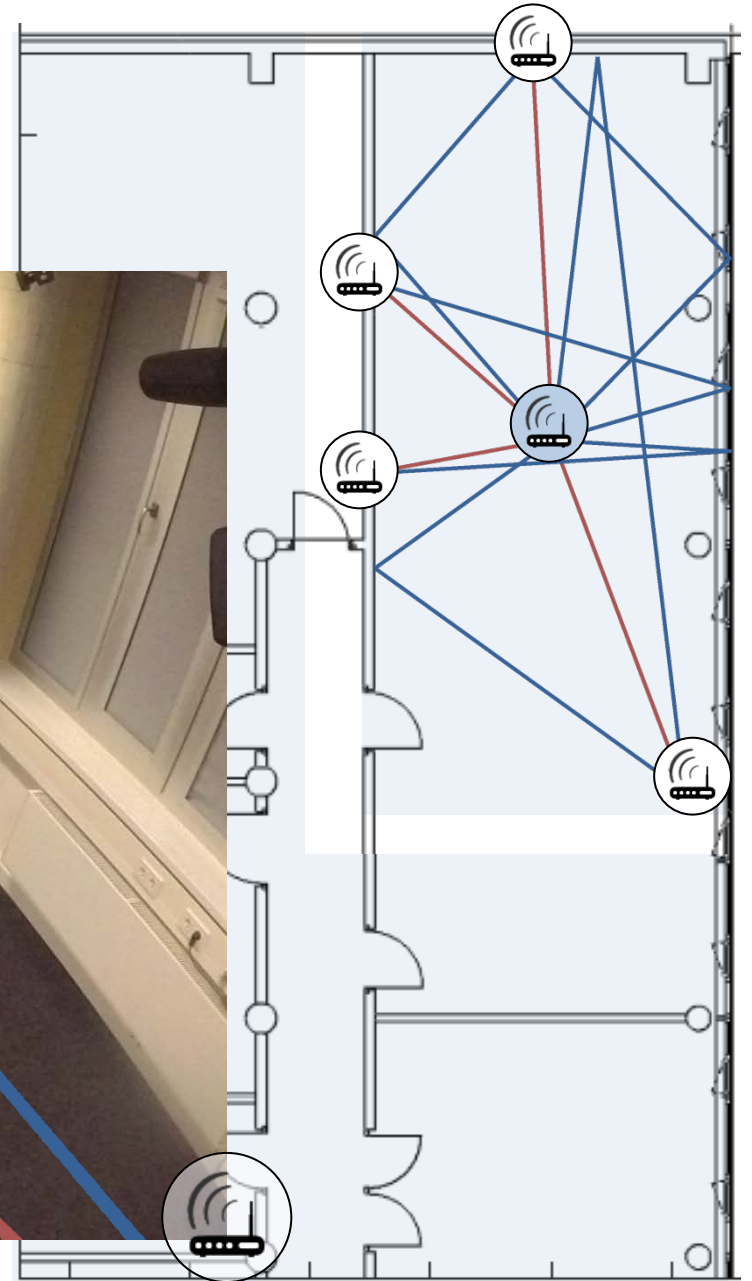
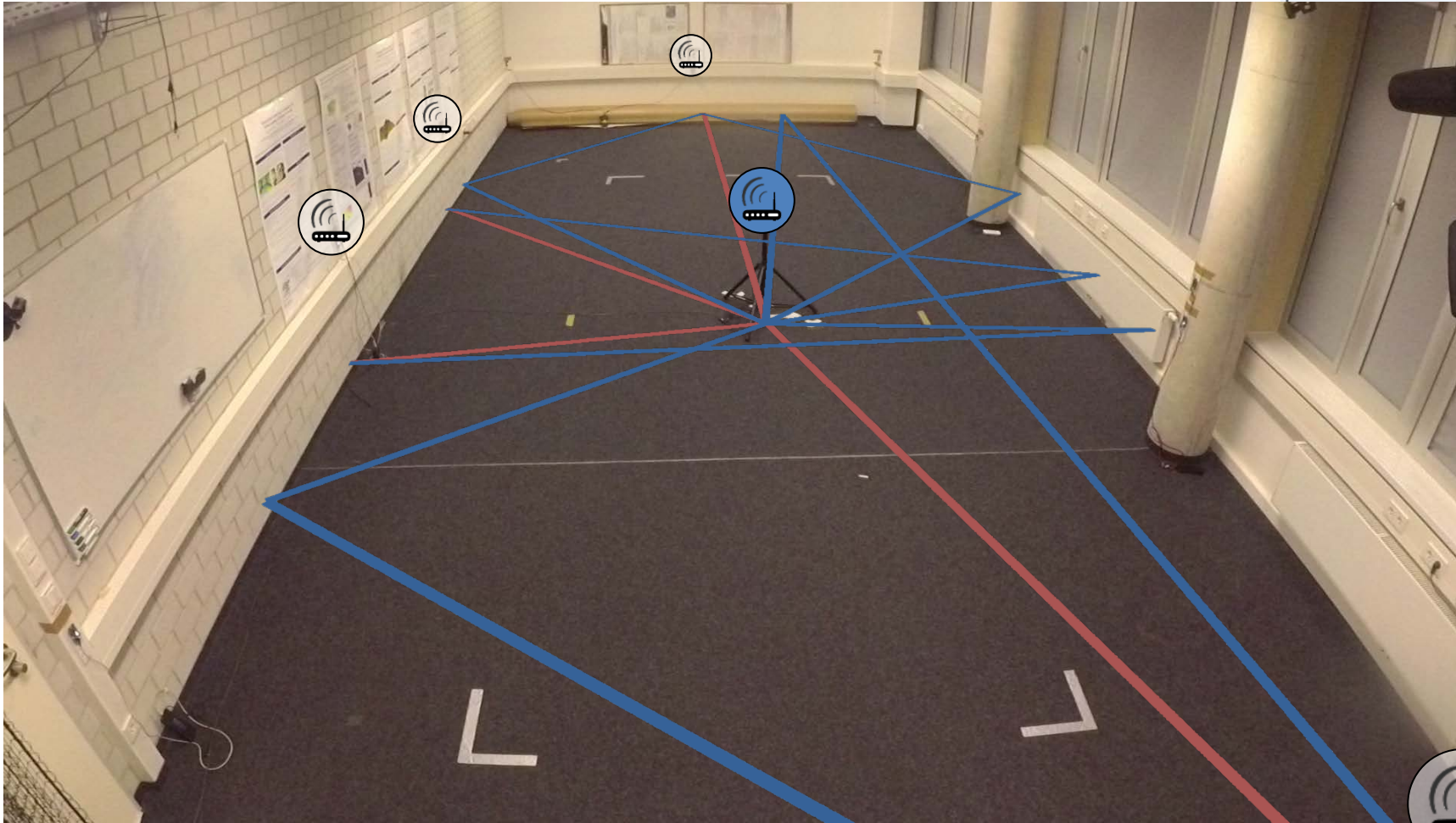
# Device-free localization and tracking Multipath-enhanced!

Preprocessing for **each pair** of transmitter and receiver





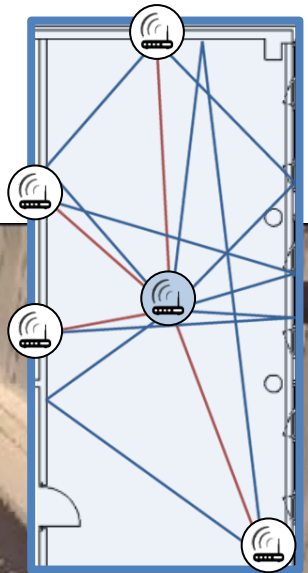
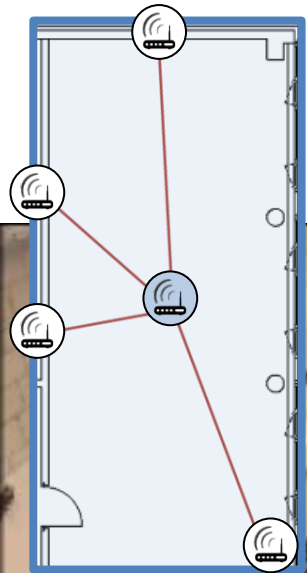
# Device-free localization and tracking Multipath-enhanced!



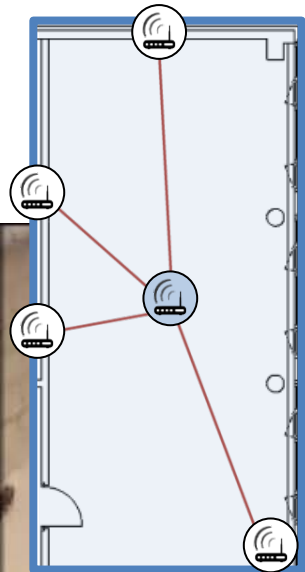
# Device-free localization and tracking Multipath-enhanced!

LoS links only

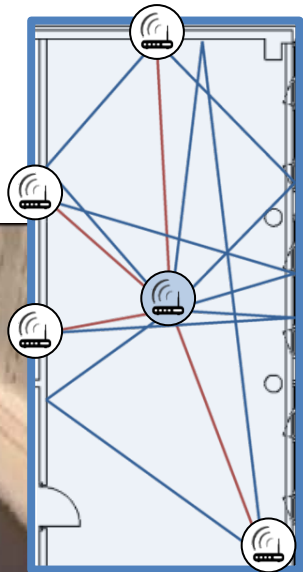
LoS and MPC links



# Device-free localization and tracking Multipath-enhanced!



LoS links only



LoS and MPC links

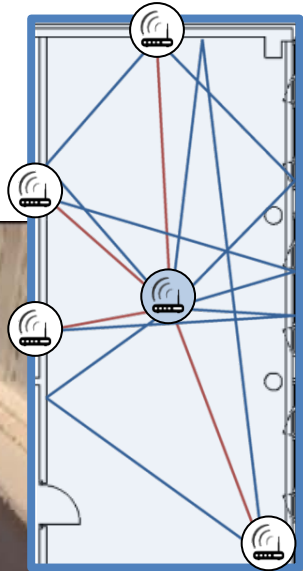
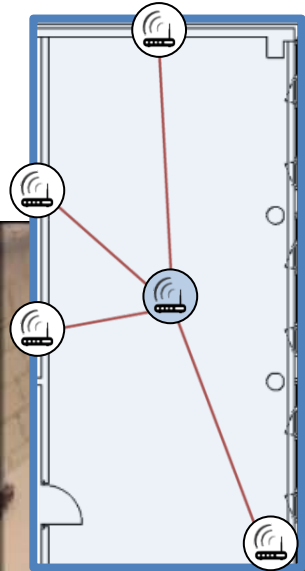


# Device-free localization and tracking

## Multipath-enhanced!

LoS links only

LoS and MPC links



# Summary – Multipath-enhanced Device-free Localization and Tracking

- Multipath propagation enhances device-free localization!
- Low-cost UltraWideband nodes are sufficient

