Wireless Localization

CSE 599 N1: Modern Mobile Systems

modernmobile.cs.washington.edu

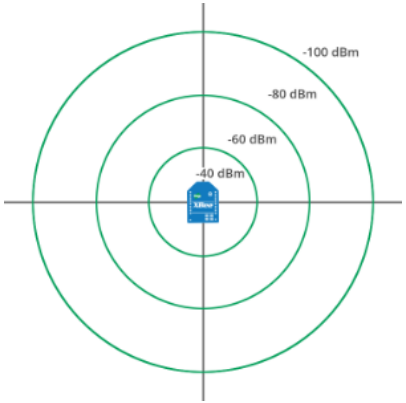
Basic Setup

Active Localization:

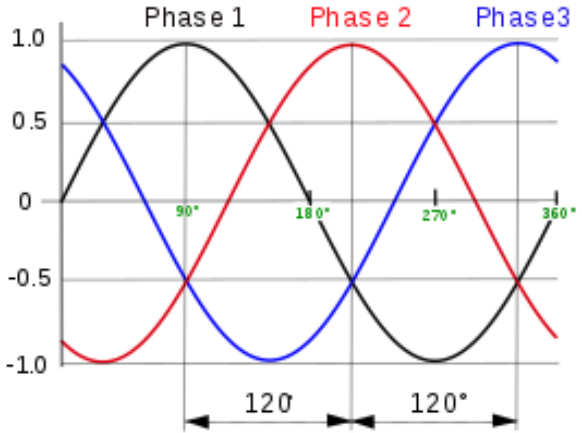
The device can transmit or receive signal

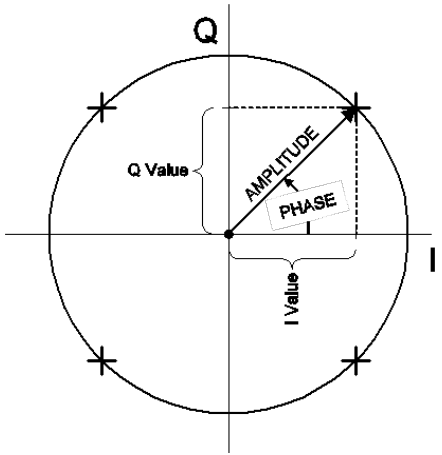
Parameters used in Wireless Localization

1) Received Signal Strength Indication (RSSI)



2) Phase

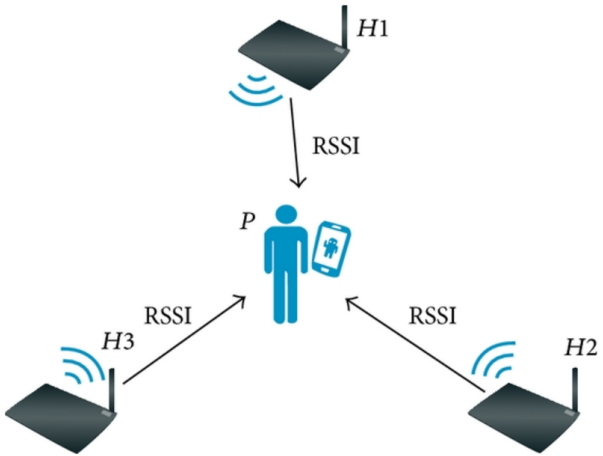




Rssi based Localization

Training phase - Build model

Testing phase – model look up



Phase based Localization

- Rssi is course grained
- Phase has higher resolution
- Resolution is inversely proportional to wavelength

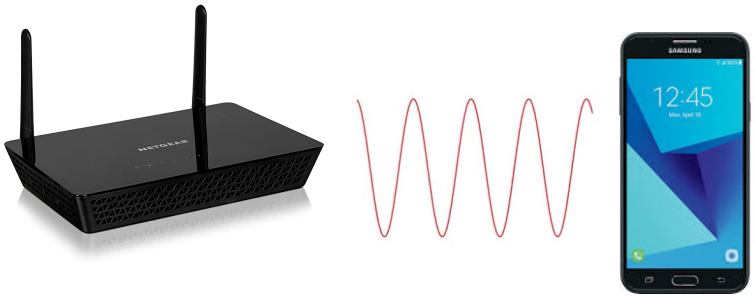
Two general types of phase based localization

1) Time of Arrival estimation
2) Angle of arrival estimation

1) Time of Arrival Estimation

Measure time of arrival of signal from transmitter to receiver

Distance = time X speed



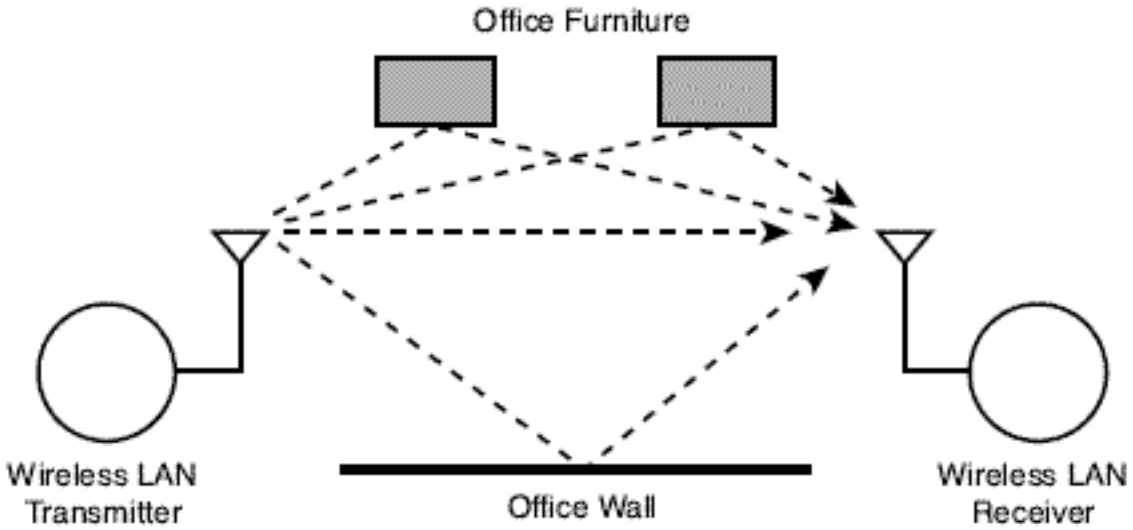
$r = A \cos(2\pi f t + \Phi)$

$t = \Phi/(2\pi f) \bmod (1/f)$

$d = (\Phi/(2\pi) * \lambda + n\,\lambda)\, c$

Use two frequencies to solve n

Multipath

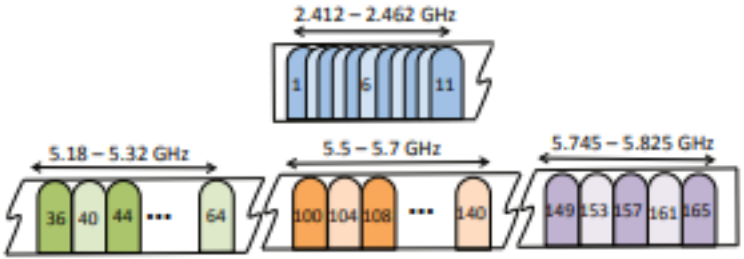


Received phase is affected by multipath!

Solution

Different frequencies have different properties.

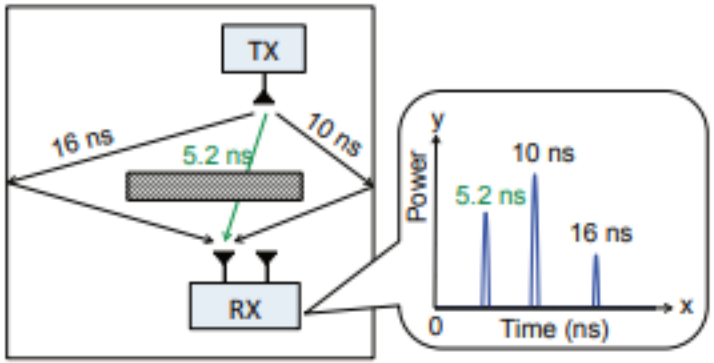
Solution: Use bandwidth



Solution

Channel response for all frequencies. Looks like an FFT

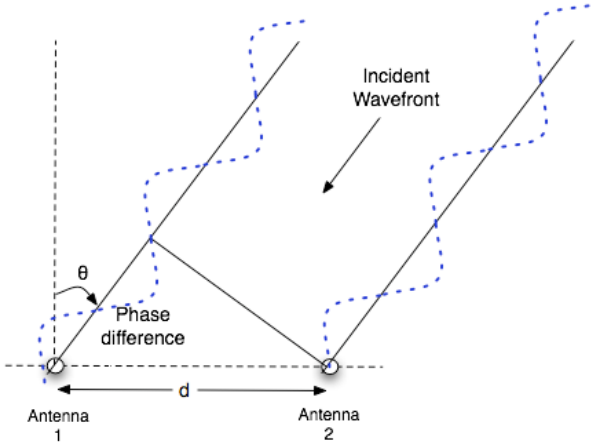
Solution: Take inverse FFT to get time domain signal.

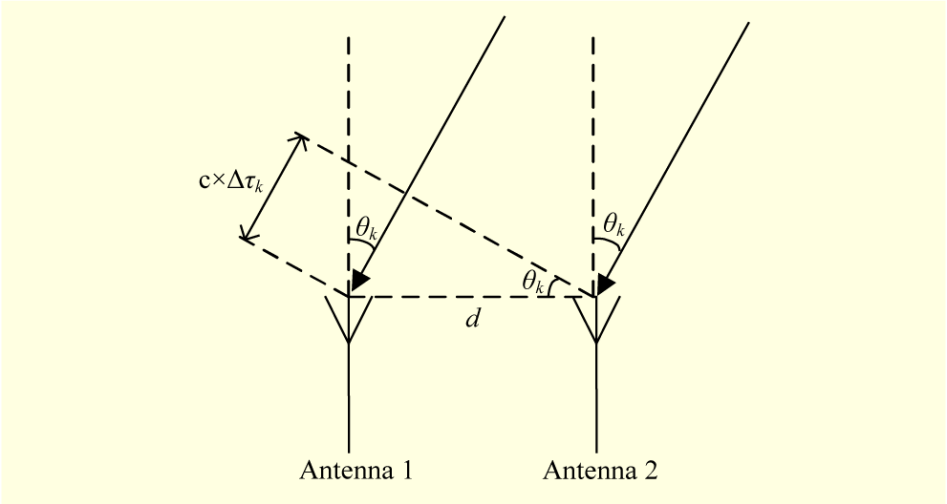


(a) Testbed (b) Multipath Profile

Angle of Arrival Estimation

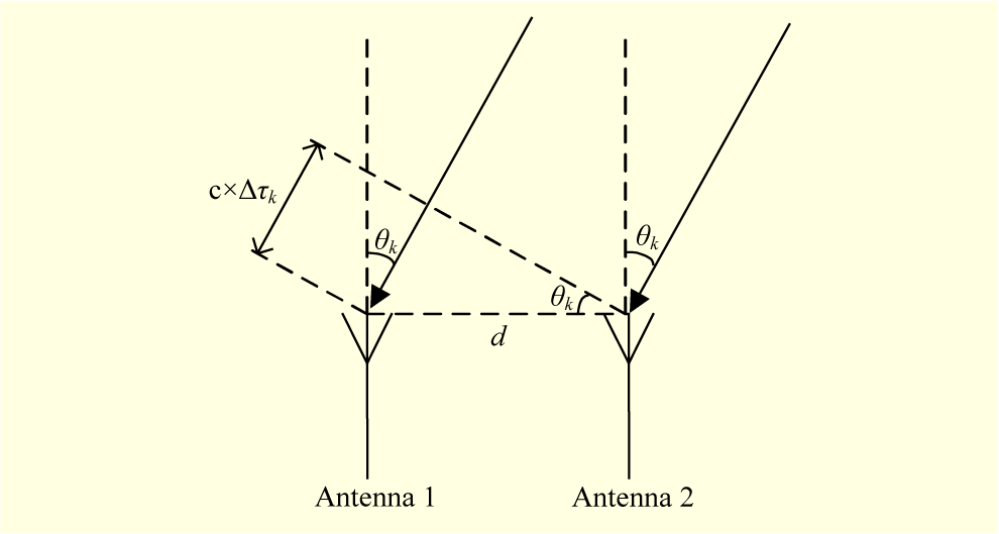
Need Multiple antennas





Multipath

Need Multiple AP



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Multipath

Need Multiple AP

AP3

AP1

AP2

Assumptions

LoS path exists !

Error increases with number of obstructions

Does not work great across multiple floors.

RFID