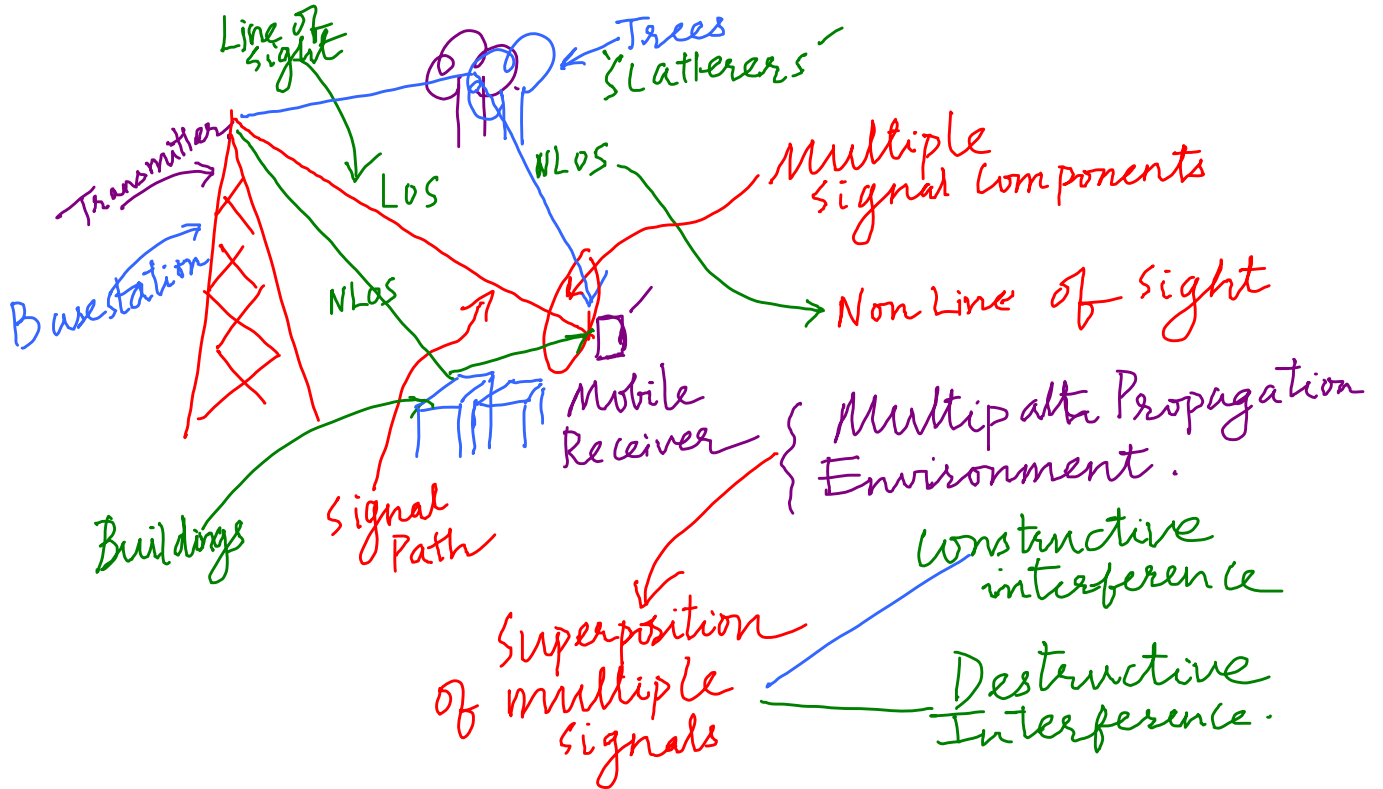


Challenges for wireless:



Constructive
interference



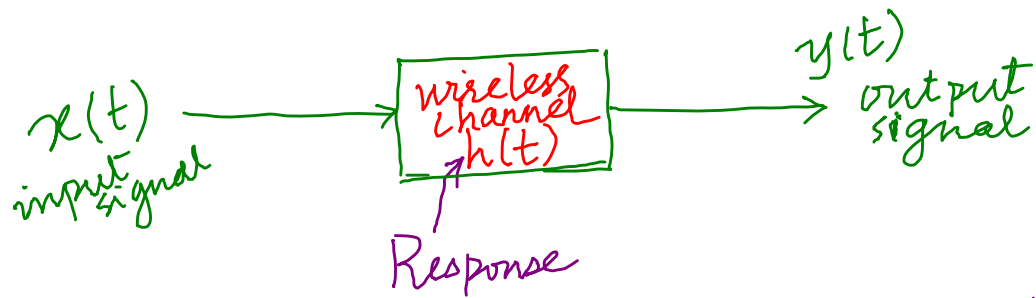
Amplifies received
signal amplitude.

Destructive
Interference



Attenuates received
signal amplitude.

Develop a model for multipath
propagation.



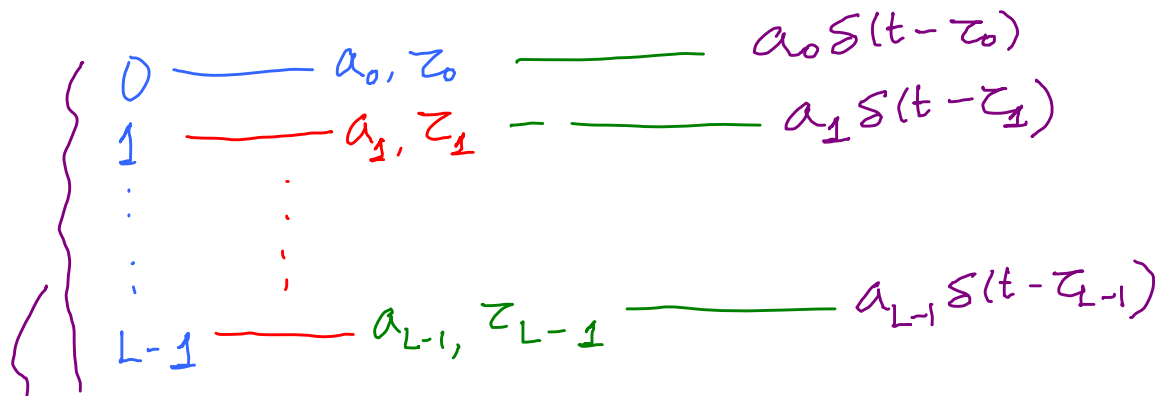
i th path of wireless environment is characterized by

— Delay τ_i

— Attenuation a_i

$a_i \delta(t - \tau_i)$ ← Impulse shifted by τ_i

Multipath Scenario:



Multipath response

= Sum of individual responses.

$$\begin{aligned} h(t) &= a_0 \delta(t - \tau_0) + a_1 \delta(t - \tau_1) + \dots \\ &= \sum_{i=0}^{L-1} a_i \delta(t - \tau_i) \quad \dots + a_{L-1} \delta(t - \tau_{L-1}) \end{aligned}$$

$$h(t) = \sum_{i=0}^{L-1} a_i \delta(t - \tau_i)$$

↓
impulse response
of channel.

Transmitted Signal

$$s_p(t) = \text{Re} \left\{ \underbrace{s(t)}_{\substack{\text{complex} \\ \text{Baseband} \\ \text{signal}}} e^{j 2\pi \underbrace{f_c t}_{\substack{\text{Carrier} \\ \text{Frequency}}}} \right\}$$

Passband signal.

$f_c \sim 900 \text{ MHz}$ GSM

3G — 2.1 GHz
4G — 2.5 GHz