

EE 597

Lecture 3

5/25/2016

Recap.

Phy Layer

- Digital communications
  - modulation schemes
  - performance under AWGN.

- Radio propagation modeling
  - Simple path loss model
    - w/ lognormal fading
  - Markov channel model
  - Performance of modulation schemes under fading.

AWGN

monotonically decreasing  
SNR

$$\text{BER} \rightarrow P_b = f(\gamma)$$

fading channel

characterizes the radio

$\gamma$  is a random variable  
with some pdf  $g(\gamma)$

fading distribution

characterizes the environment

2 approaches to characterizing  
performance.

Approach 1:  $E[P_b] = \int_{-\infty}^{\infty} f(\gamma) g(\gamma) d\gamma$   
 $\nearrow$  expected or average bit error rate

Approach 2: start w a BER threshold  
 $P_b^{\text{th}}$  s.t. want  $P_b < P_b^{\text{th}}$ .

given  $f(\gamma)$  can derive an SNR threshold  
 $\Theta_{\text{out}}$  s.t. want  $\gamma > \Theta_{\text{out}}$

$$P_{\text{outage}} = \Pr[\gamma < \theta_{\text{out}}]$$
$$= \int_{-\infty}^{\theta_{\text{out}}} f(\gamma) d\gamma$$

what can we do to control the  $E[P_b]$  or  $P_{\text{outage}}$ ?

- increase signal power
- change modulation scheme

(lower rate)

power - throughput - error rate