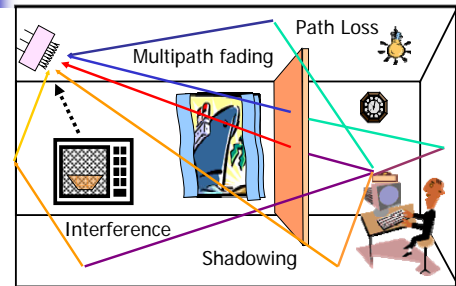


Overview of Wireless Channel Impairments

ECE 4606
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The Wireless Channel



Path Loss

- In free space, the radio waves travel outward from the transmitter in an expanding sphere
- The received power decreases with the inverse distance squared:

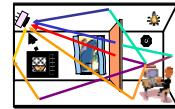
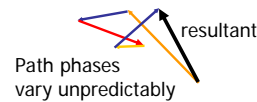
$$PL \text{ (dB)} = -10 \log \frac{G_t G_r \lambda^2}{(4\pi)^2 d^2}$$



- In the outdoor multipath environment, the exponent on d is approximately 4

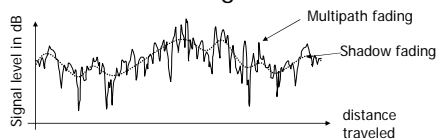
Multipath Fading

- The fields associated with the different paths add as vectors
- The magnitude of the resultant can vary as much as 40 dB as the terminals move only a few wavelengths



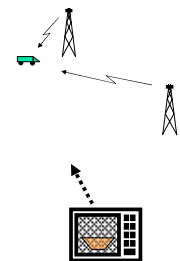
Shadowing

- Shadowing occurs when large objects block paths of propagation
- Can be observed if multipath fading is short-term averaged



Interference

- In mobile receivers, interference is from other base stations that transmit the same frequencies as the serving base station
- In wireless LANs in the 2.4 GHz unlicensed band, interference can come from other LANs and microwave ovens





Summary

- Major wireless channel impairments
 - path loss
 - multipath fading
 - shadow fading
 - interference



References

- [Lee, '98] W.C.Y. Lee, Mobile Communications Engineering, McGraw-Hill, 1998