# Trends in Wireless Communication Theory

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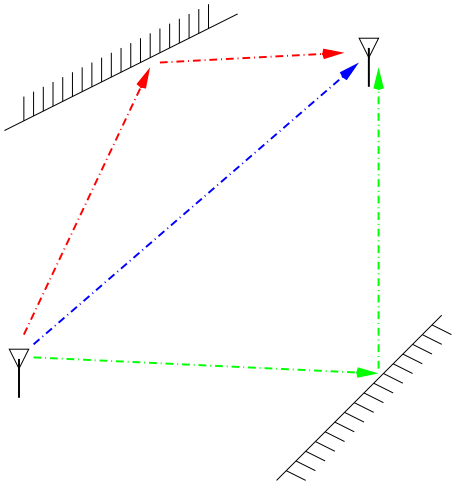
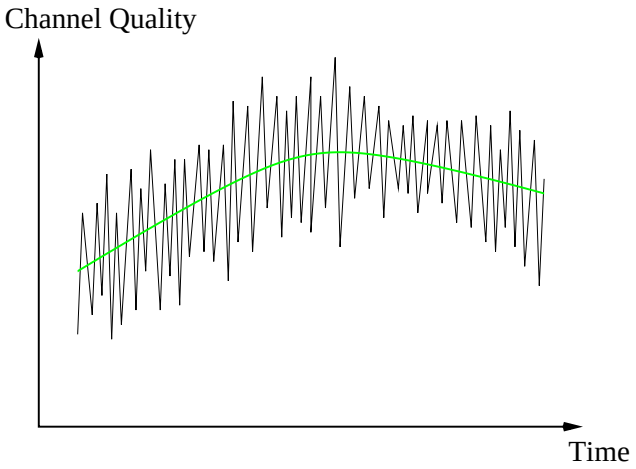
Wireless Panel, Visit Day






Fundamental challenges of wireless communication:

- multipath fading
- interference

## Classical Approach

- follows intuition and common sense.
- counteracts fading by creating diversity
- interference suppression and cancellation at the receiver
- state of affairs up til mid 90's.

## Information Theoretic Approach

Since mid 1990's, information theory brings a fresh look at the problem.

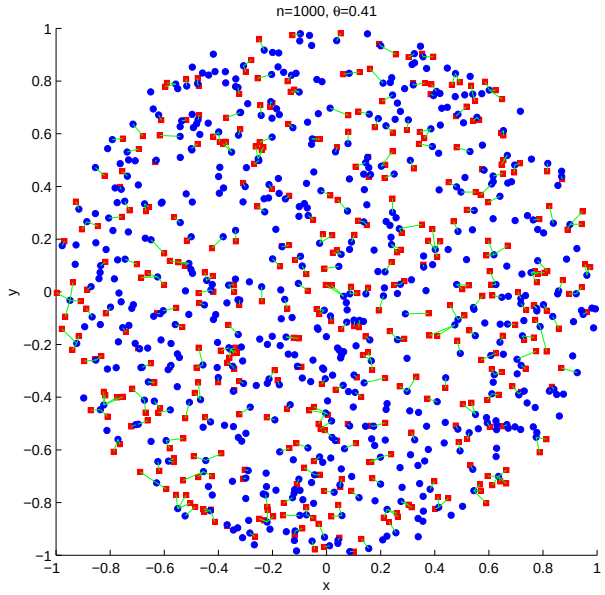
Leads to counter-intiutive and radically different ways of communicating over wireless channels.

## Fading can be Cool

Fading randomizes the channel:

- high throughput by transmitting when and where the channel is good : opportunistic communication
- increases degrees of freedom for MIMO communication

# Mobility Increases Capacity of Wireless Networks




Capacity of a mobile adhoc network with $n$ nodes is $\sqrt{n}$ fold larger than that of a static network.

Opportunistic communication at the networking level.

## Interference Cancellation at Transmitter

Information theory says that perfect interference cancellation can be achieved even if receiver doesn't know what the interference is!

Useful for the downlink channel where each user is not aware of information for other users'.

## Grand Challenge: Universal Spectrum Sharing

Current way of spectrum allocation is inefficient and a barrier to innovation.

Building on advances in wireless communication theory, we seek better ways.

Agenda includes ultra-wideband communication, game theoretic approaches, etc.