

Cooperative Diversity in Wireless Networks

Alex Icaza

University of Texas at Austin

Embedded Software Systems

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Overview

- Overview
- Problem Statement & Objective
- Diversity in Wireless Systems (Background)
 - Spatial Diversity
 - Temporal Diversity
- Cooperative Diversity Systems
 - Spatial Diversity (via Amplify-and-Forward Model)
 - Temporal Diversity (via Decode-and-Forward Model)
- Review & Questions

Problem Statement & Objective

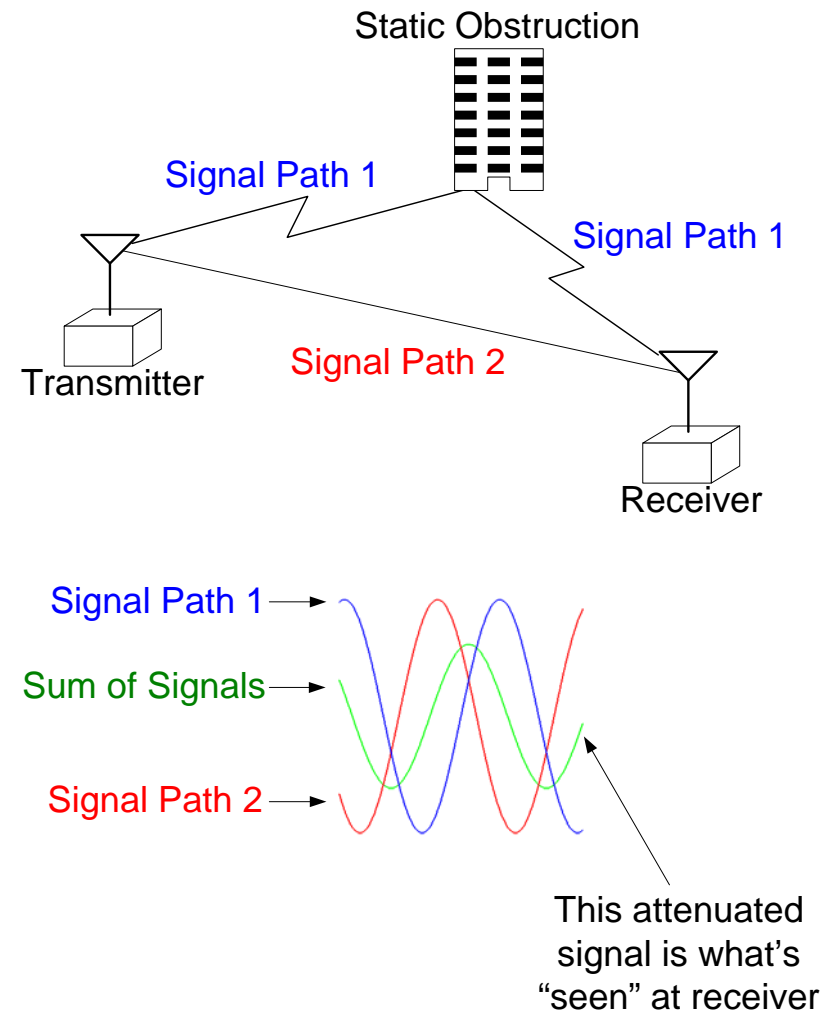
Problem:

How can we combat attenuation due to multiple destructively interfering signal paths in wireless channels?

Well known issue in wireless systems known as “**Multi-path Fading**”

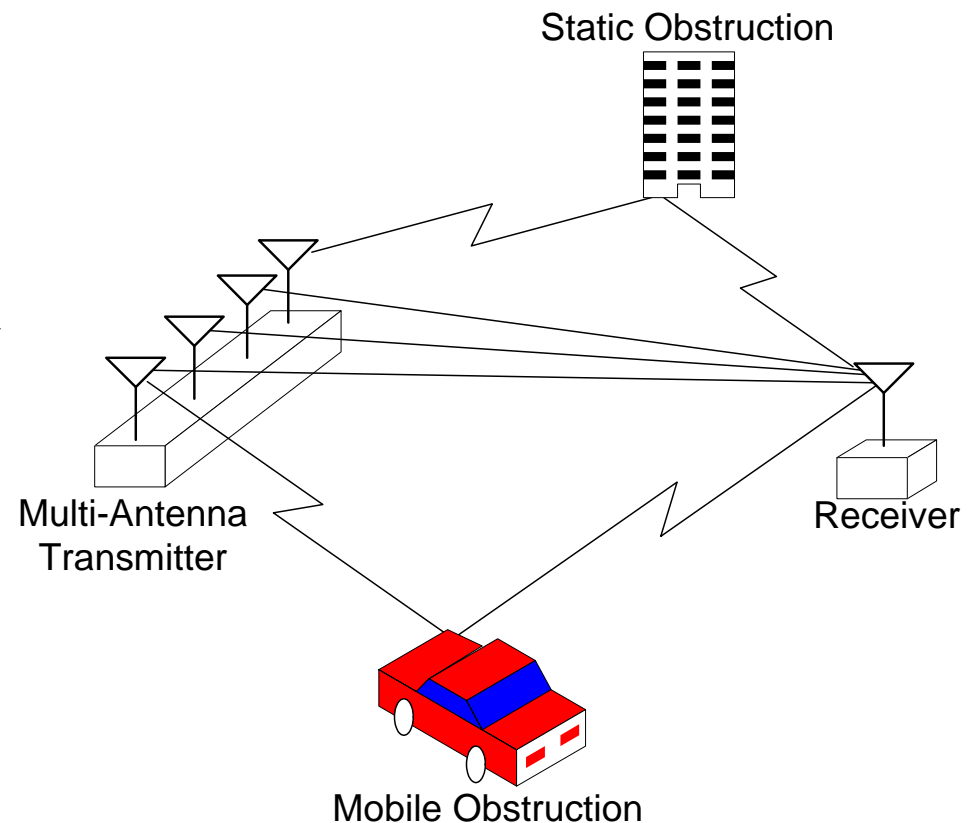
Objective:

Investigate and model low complexity, energy efficient solutions for combating multi-path fading.



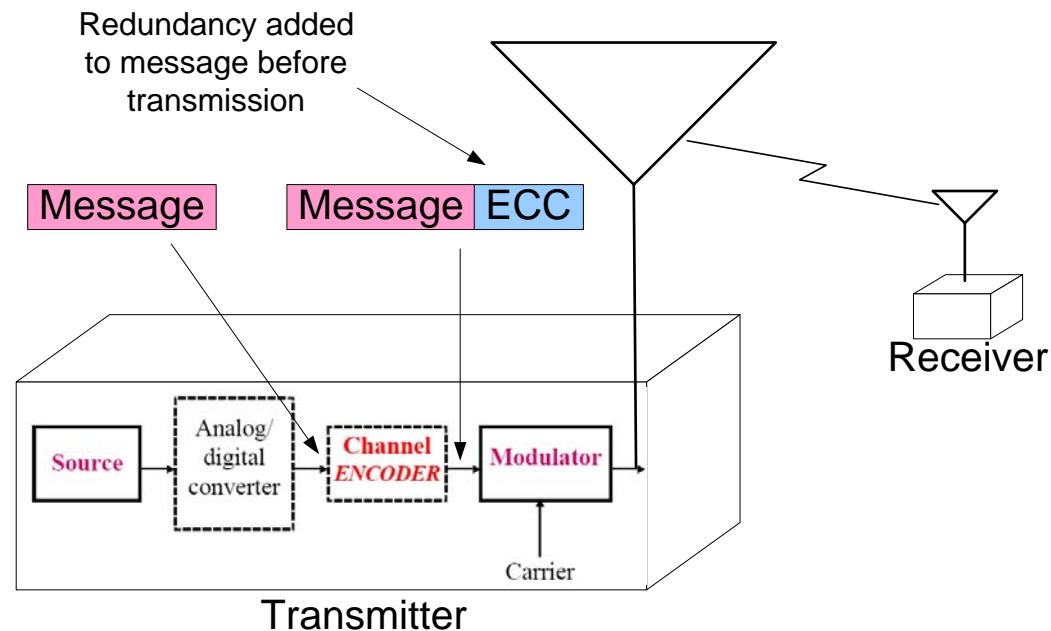
Spatial Diversity in Wireless Systems

- Combats fading by transmitting copies of original signal through uncorrelated paths to receiver.
- Signals combined at receiver and individual channels effects are averaged
- Antenna arrays are currently the most common way of achieving spatial diversity



Temporal Diversity in Wireless Systems

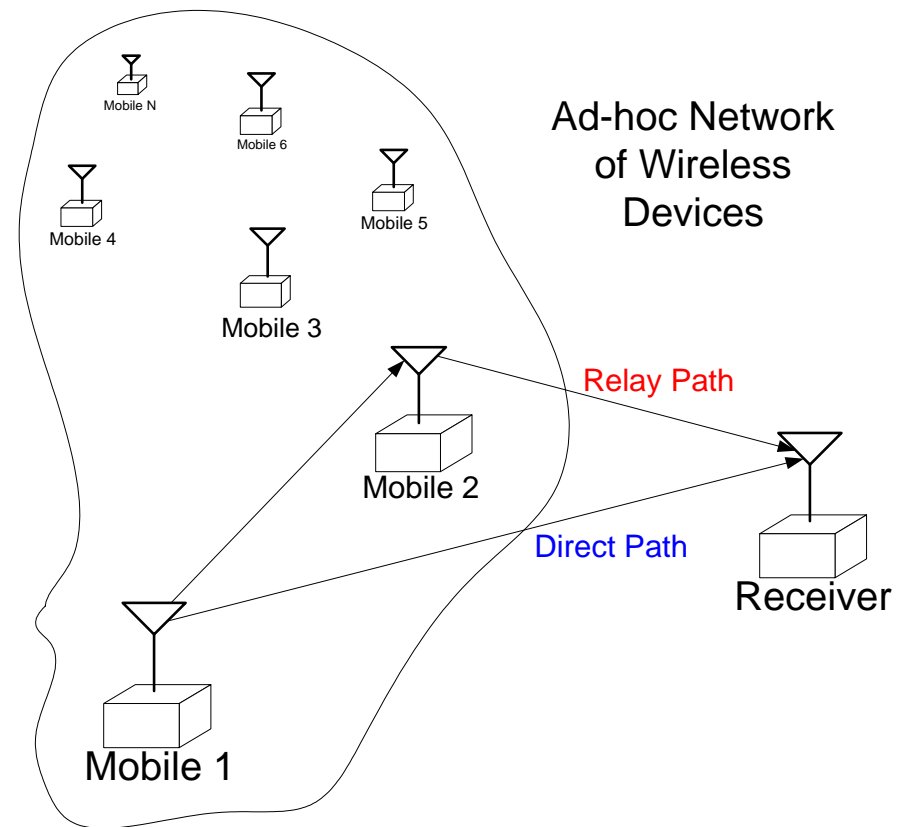
- Achieve diversity in time by transmitting redundant information with original data (i.e. Error Correction Coding)
- Receiver uses redundant information to correct errors caused by channel fades



Cooperative Diversity

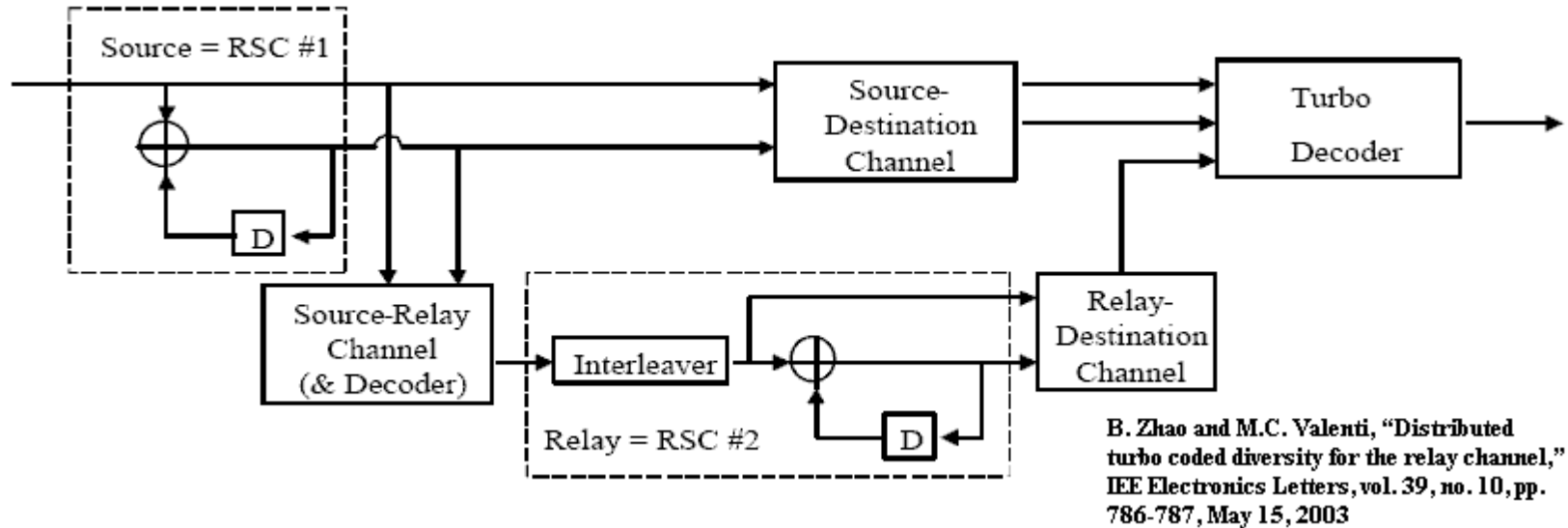
Spatial Diversity Advantage

- Collection of wireless nodes distributed in space (i.e. ad-hoc network)
- Nodes cooperate by retransmitting each others signals
- Collection of nodes becomes a “distributed antenna array”
- Relay nodes simply amplify-and-forward signal to receiver.



Cooperative Diversity

Temporal Diversity Advantage



- “Distributed turbo code” for relay channel
- Uses decode-and-forward model
- Source node encodes data and transmits
- Relay node decodes source’s data, interleaves message bits, re-encodes data and retransmits

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- Questions?