

Adaptive Array Processing for Ad Hoc Networks

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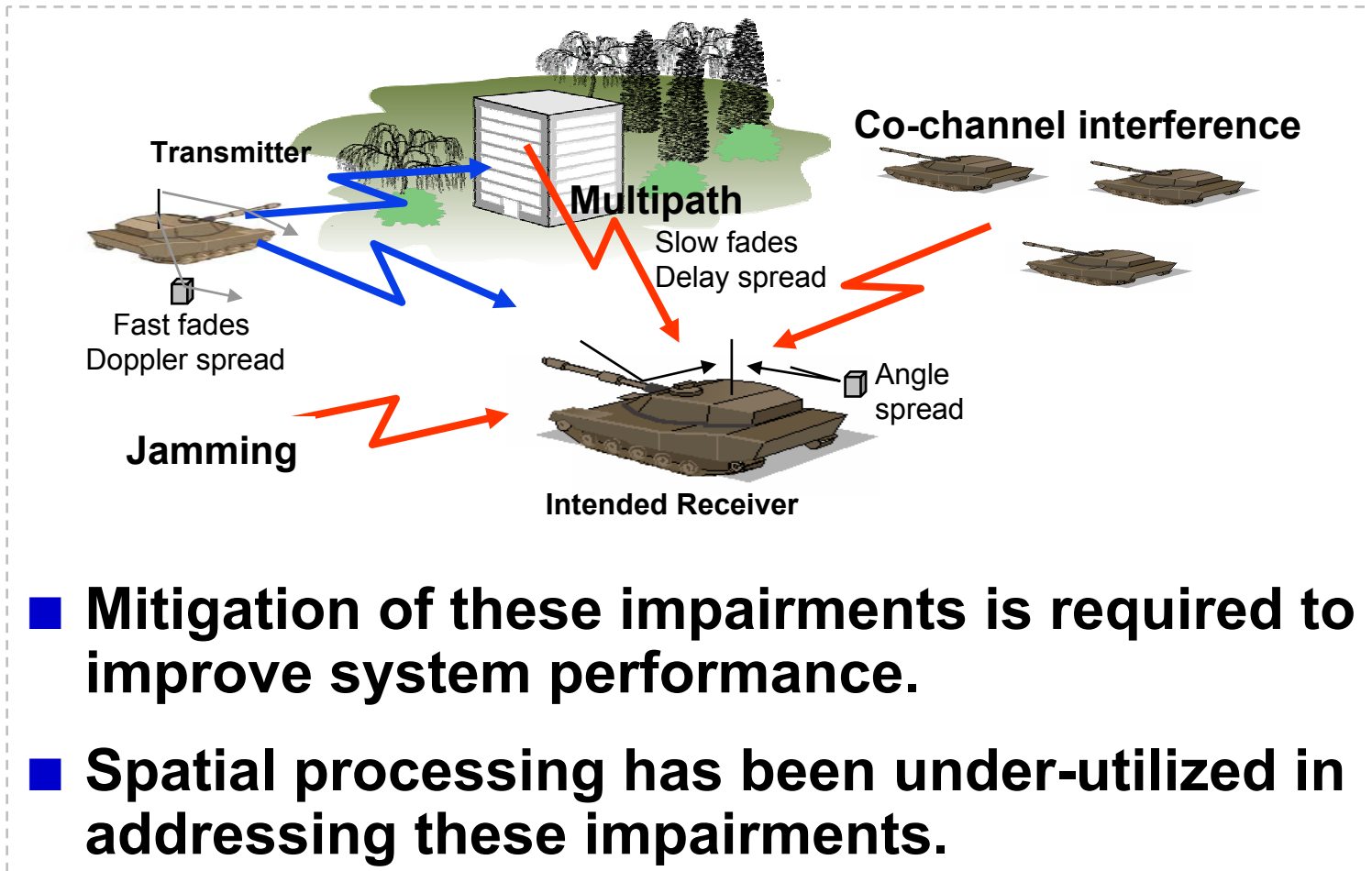
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Problem

- **As demands on military mobile ad hoc networks (MANETs) increase, more advanced techniques are required to combat the effects of multipath fading, hostile jammers, and co-channel interference**
- **Adaptive array processing techniques improve performance, but current algorithms are not well suited for military environments.**
- **New array processing algorithms are needed that are robust, computationally inexpensive, and tailored for ad hoc networks.**

Background



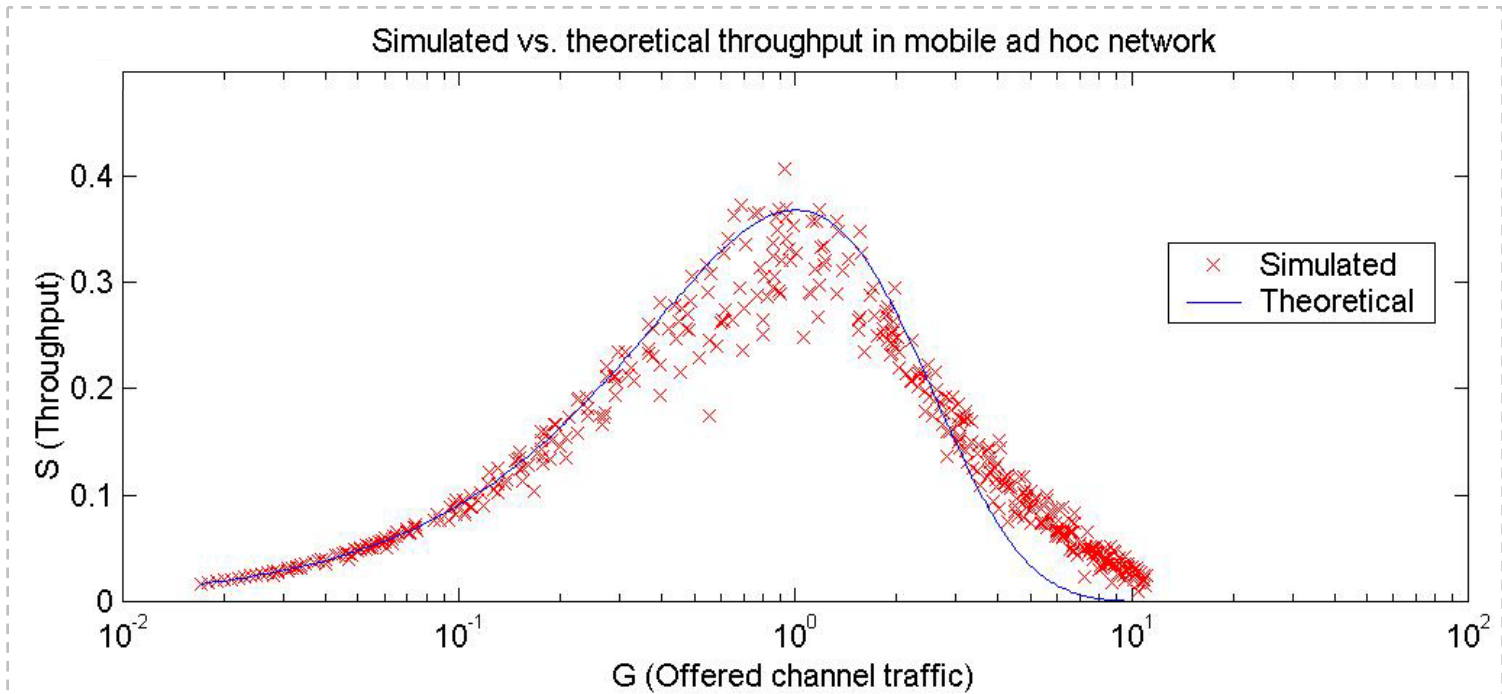
Objective

- **Create a simulation that demonstrates statistical performance of adaptive arrays in peer-to-peer networks**
- **Determine lower bounds on degrees of freedom required for significant performance improvement**
- **Develop blind/semi-blind receive and transmit space-time adaptive processing (STAP) algorithms**
- **Test algorithm performance using recorded multi-sensor data**

Activities

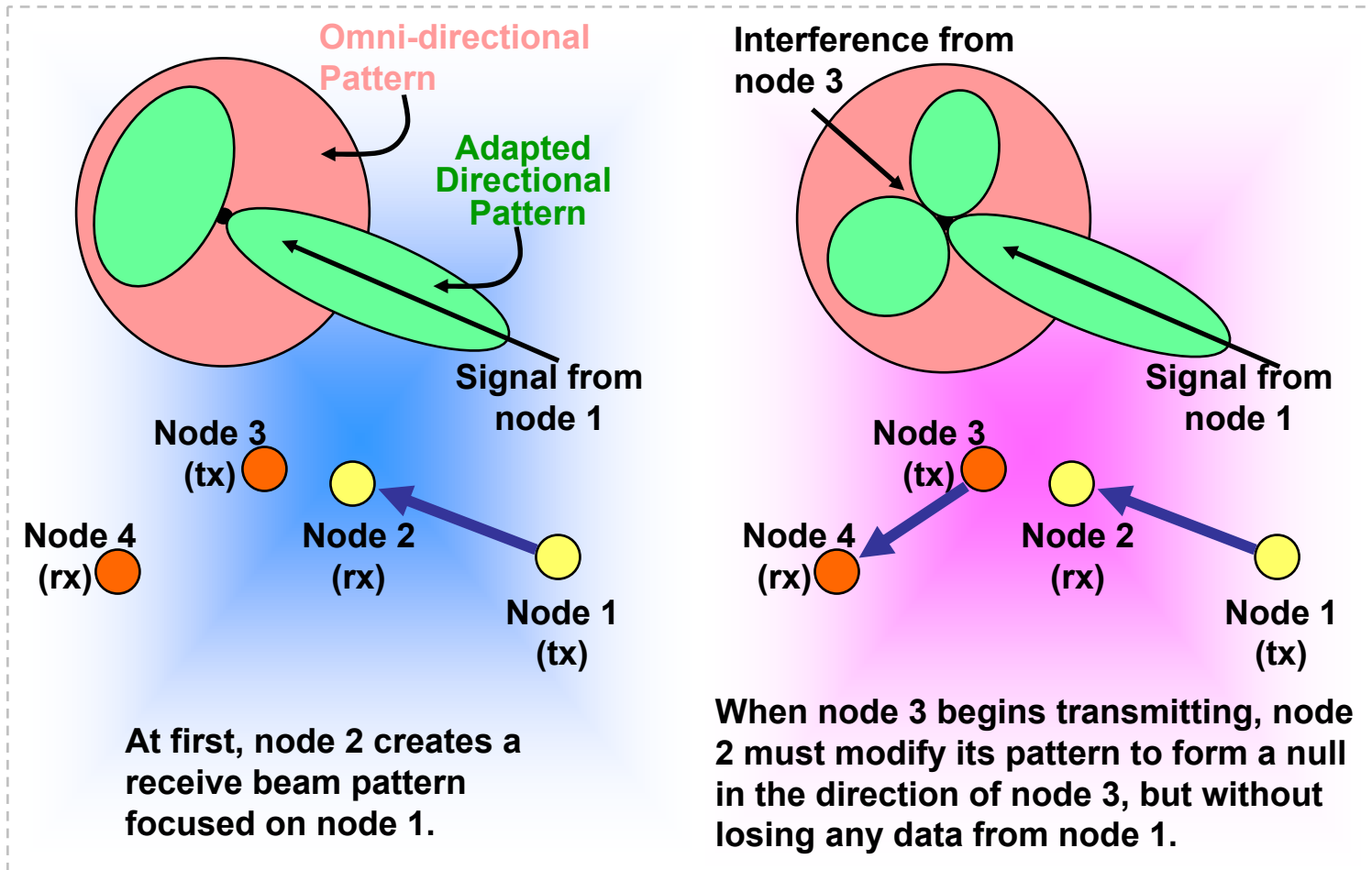
- **Designed a system level simulation in MATLAB which determines statistical performance of different kinds of antenna responses (e.g. omni, sectored, optimal beamform) to in mobile ad hoc networks**
- **Developed an algorithm for separation of signals from two different transmitters by a single adaptive array processing receiver**
- **Analyzing impact of multipath/multi-angle impairments to determine the number of array elements and filter taps required by the adaptive receiver**

Highlight



Simulated performance of system throughput in a mobile ad hoc network

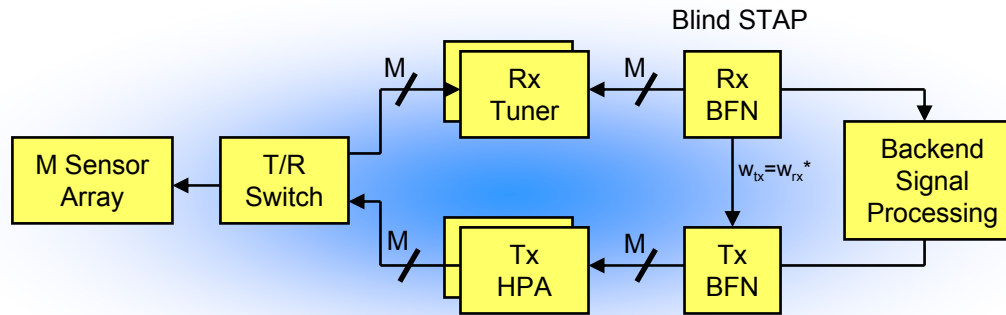
Highlight



Impacts

- **Array processing techniques being developed will increase range and data rates, while reducing packet collisions, vulnerability to friendly and hostile interference, and probability of interception and detection**
- **Provides improvements to communications systems that are primarily ad hoc, such as DARPA Future Combat Systems (FCS) communications.**

Future Plans



- Demonstrate the capacity improvements in a MANET when blind adaptive array processing methods are used
- Develop adaptive transmit beamforming methods for MANETs
- Develop new network access protocol that exploits the advantages of spatial diversity.