Space-Time Processing for Mobile Ad-Hoc Networks

Networks & Communications

Objective:

- Design of ad hoc networking architectures that utilize multiple antennas at each node.
- Define the best way to utilize multiple antennas at each node to improve the robustness, capacity, and quality of service of the network.
- Develop new radio network technologies that provide an extended coverage range without the use of centralized control.

Technical Approach:

- Cross-layer optimization that incorporates spatial information from the physical layer in the routing and scheduling protocols.
- Exploitation of the available time, frequency and spatial diversity to improve network performance.
- Utilize combinations of physical and network layer diversity to maximize network capacity and robustness in a reliable fashion.

DoD Benefit:

- Provide reliable battlefield communications in hostile, rapidly changing environments with easy deployment and no single-node failure.
- Specifically address vulnerability to jamming and destruction of nodes
- Provide dynamic network reconfigurability using multiple antennas at each node
- Specifically address network sensitivity to node mobility

Budget:

	FY04	FY05	FY06	FY07	FY08	FY09
Planned/ Actual $K	$452 K	$1056 K	$1075 K	$1191 K	$1127 K	$349 K
	$416 K	$1026 K	$ 932 K	$1326 K	$1105	

Dates and location of Major Reviews/Meetings:

- Kickoff Meeting- San Diego, CA 6/15/04
- 1st Annual Program Review-San Diego, CA 7/28/05
- 2nd Annual Program Review- San Diego, CA 9/14/06
- 3rd Annual Program Review- San Diego, CA 9/18/07
- 4th Annual Program Review- San Diego, CA 10/16/08

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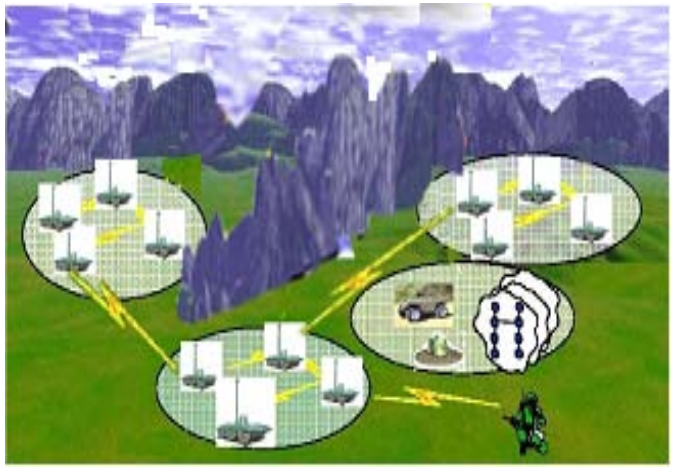

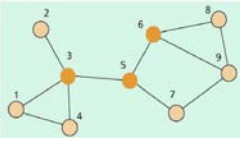

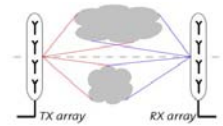

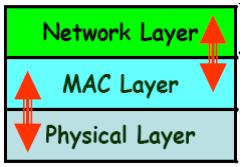

Technical Accomplishments/Major Breakthroughs/Successes:

- Significant advances in cross-layer optimization has been achieved. Network design parameters such as throughput and information efficiency can now be related to physical layer and channel parameters
- Scheduling and routing protocols based on physical layer parameters are being designed.
- New, more robust, channel models for network design are being developed.
- New space-time modulation and coding schemes with increased time diversity have been developed to counter the effects of node mobility.
- New channel estimation schemes based on channel distribution statistics have been developed and shown to provide significant improvements in mobile networks.
- Improved space-time coding schemes that reduce the effects of channel feedback errors in mobile channel have been developed.
- Optimal capacity for unicast applications achieved by multi-packet transmission and reception implemented at the physical layer