

Mobile Ad Hoc Networking for the Transformed Army (MANTA)

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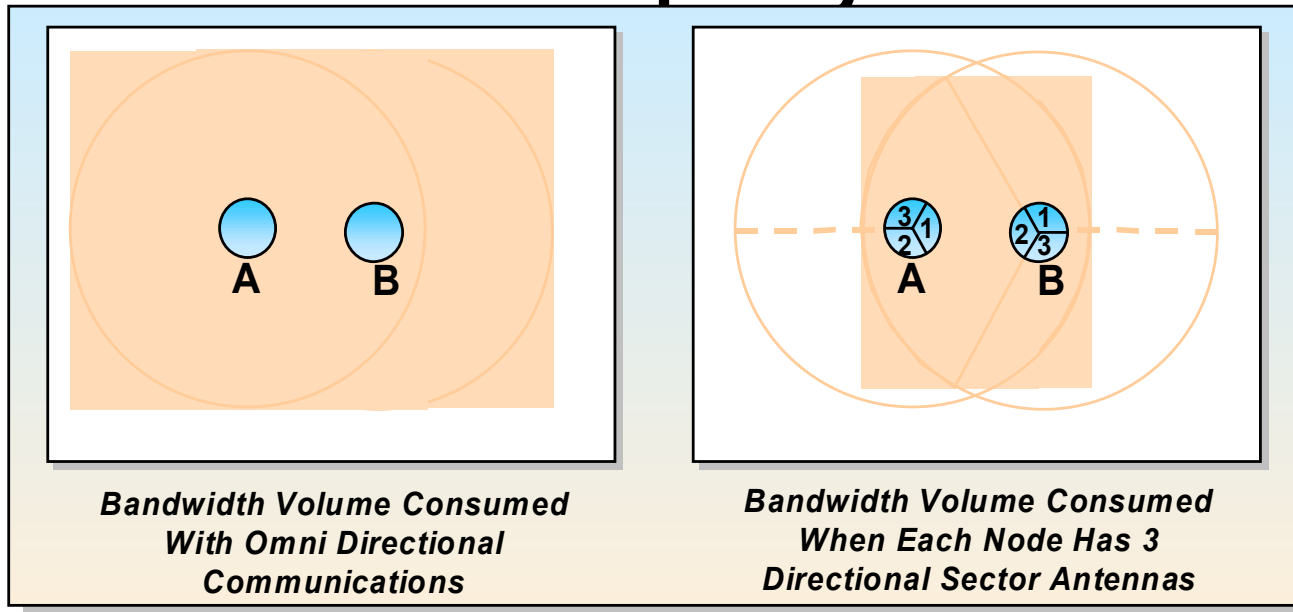
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Problem

- **Highly directional communications are needed for Army transformation in order to provide:**
 - **Dramatically higher data rates,**
 - **Low probability of detection, and**
 - **Resistance to jamming**
 - **In highly mobile networks.**
- **Current mobile ad hoc networking techniques neither embrace directionality nor accommodate the qualities of service necessary to support the C4ISR collaborative applications needed.**

Background

- Directional communications consume smaller bandwidth volumes and enable increased spatial reuse of spectrum, resulting in increased network capacity.



- But existing contention based access schemes rely upon omnidirectional communications...

Objective

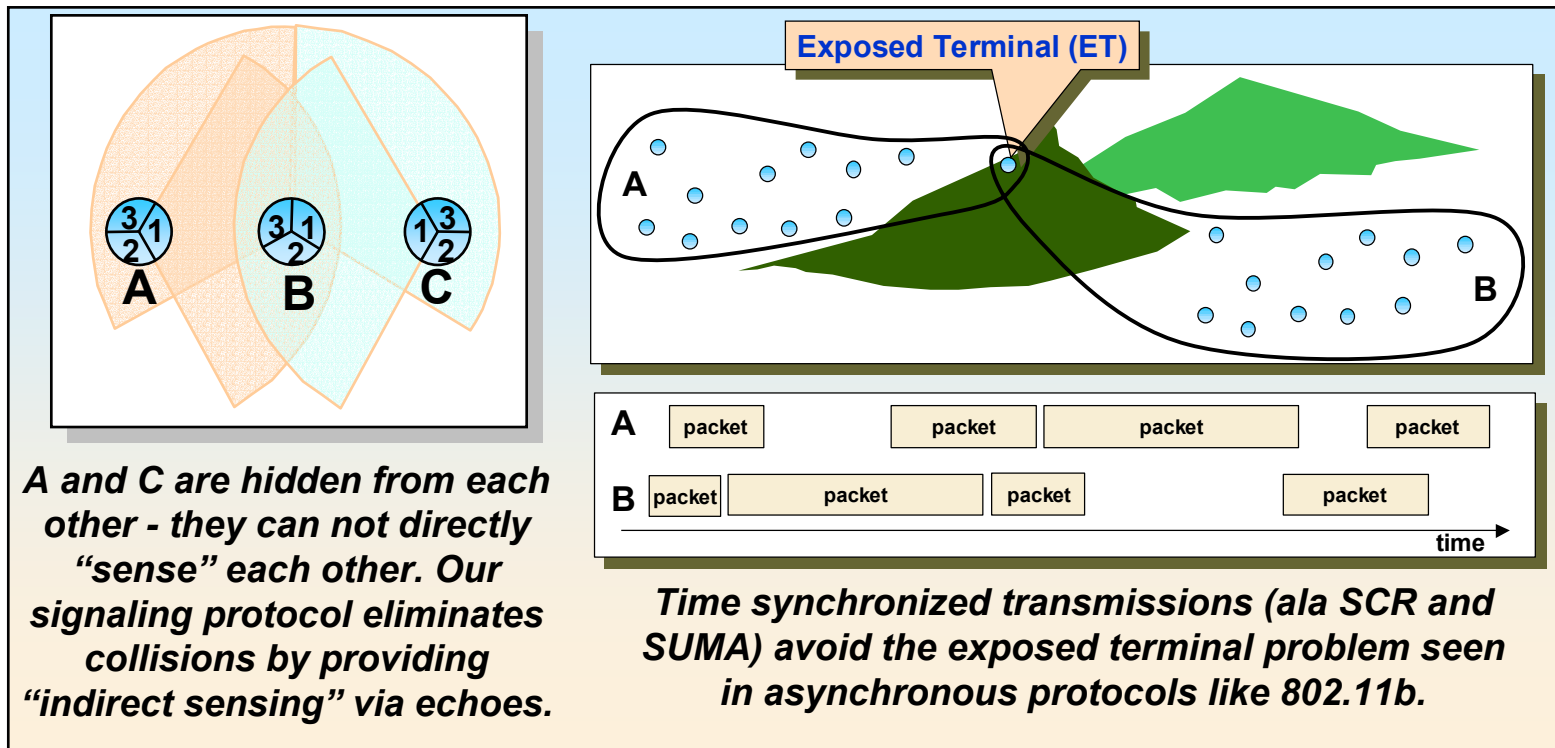
- **What channel access mechanisms are most appropriate for ad hoc networks that combine directional and omnidirectional elements (aka directional ad hoc networks)?**
- **How should one initiate and maintain a network topology in directional ad hoc network environments?**
- **What routing algorithms are necessary to achieve standard (unicast), high-assurance, and multipoint data delivery services in directional ad hoc networks?**

Activities

- We have developed channel access protocols for ad hoc networks that support both omnidirectional and “modestly” directional communications. These protocols have been implemented in our proof-of-concept prototype directional radio system.
- We are actively developing channel access mechanisms for “highly” directional communications that will provide stealthy high data rate links.

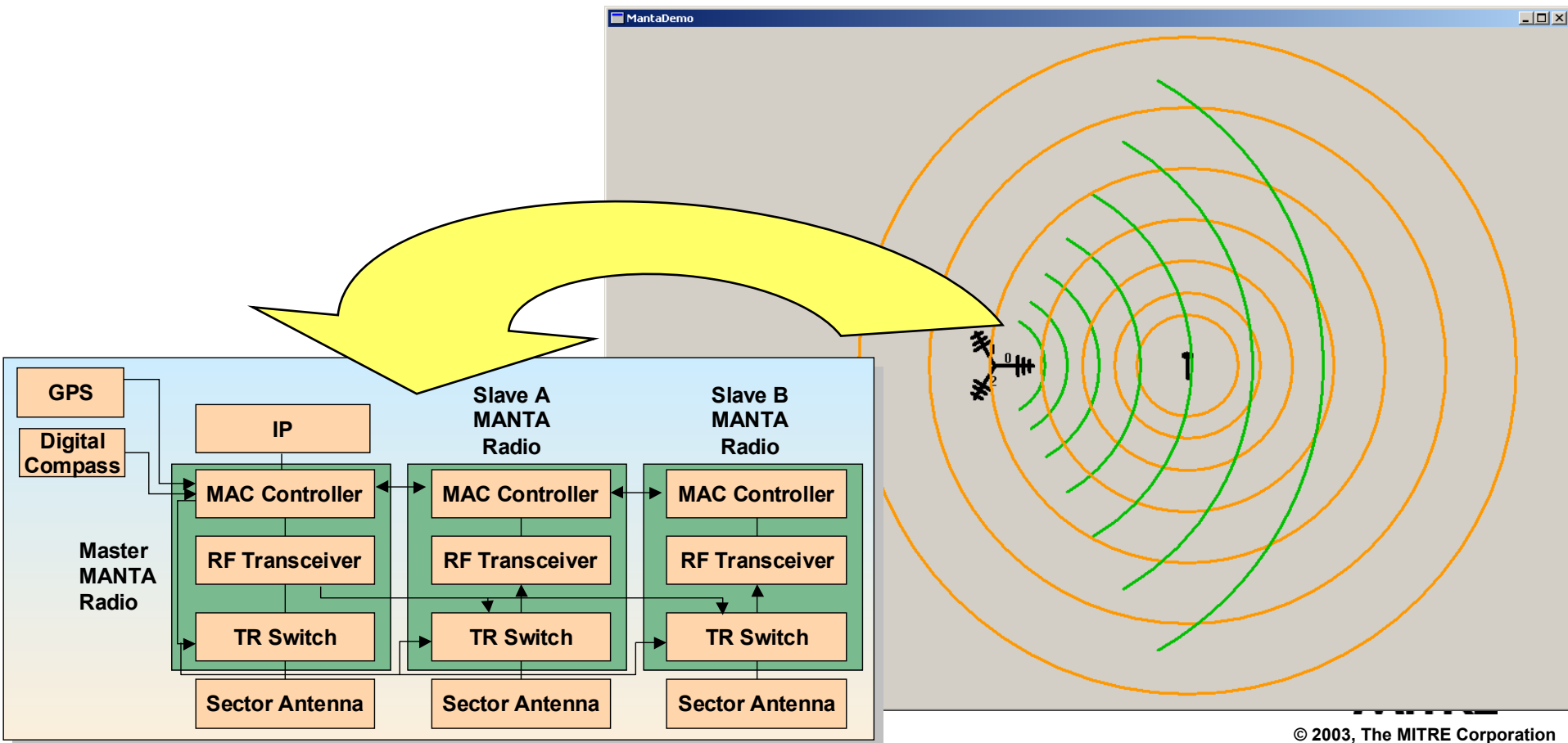
Highlight

- We have developed channel access techniques that ensure fairness while avoiding the classic “hidden terminal” and “exposed terminal” problems.



Demonstration

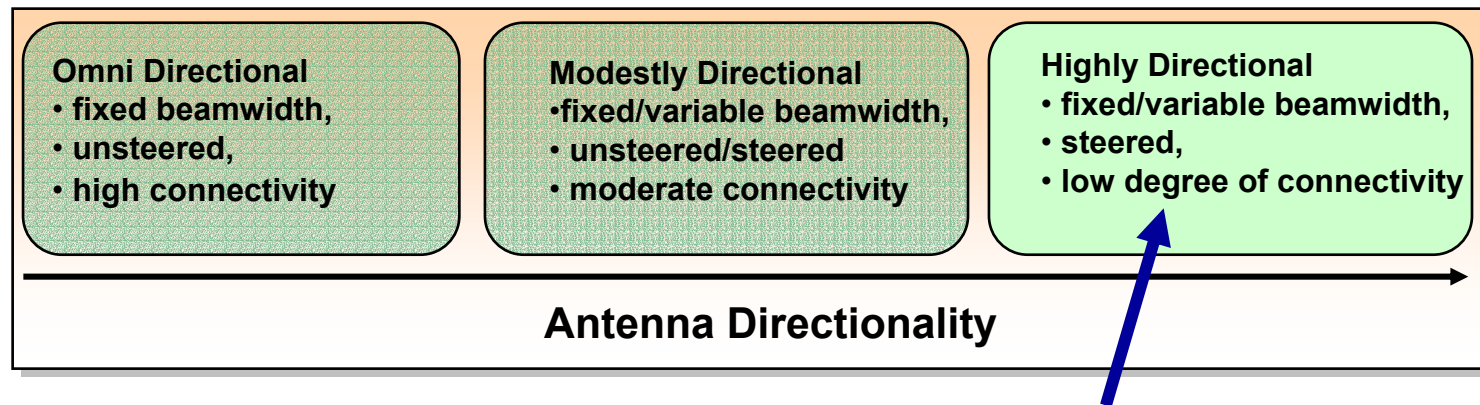
- We have developed a modestly directional communication system prototype that demonstrates dynamic antenna selection to improve spatial reuse.



Impacts

- **Published paper “Orchestrating Spatial Reuse in Wireless Ad Hoc Networks Using Synchronous Collision Resolution” in *Journal of Interconnection Networks*, March 2003**
- **Presented two posters for the Army Science Conference 2002: “Random Cellular Networks for Tactical Communications,” and “Methods to Achieve Capacity and Quality of Service in Ad Hoc Networks”**
- **Presented paper “SUMA - The Synchronous Unscheduled Multiple Access Channel Access Protocol for Mobile Ad Hoc Networks” at IEEE IC3N conference, Oct 2002**

Future Plans



- **Pursue highly directional communications**
 - Mechanisms for establishing and maintaining highly directional links
 - Mechanisms to keep track of available and committed resources
 - Policies to decide where in the network to create highly directional links