Advanced Tactical Networking (ATN)

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MITRE Sponsored Research

MITRE Technology Program

Project Data

- Project Number: 51MSR227
- Funding Source: MITRE Sponsored Research
- Principal Investigator: John A. Stine
- Business Leader: Ernie Page
- Sponsor: MITRE
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- Technical Area: Comms and Networks
- External Web URL:

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Problem

- Solve the hard problems necessary for using the Synchronous Collision Signaling MAC and Node State Routing Protocols :
  - Synchronize nodes and generate location awareness within the mobile ad hoc network
  - Develop methods to collect and disseminate empirically observed propagation conditions and use them for topology determination
  - Heterogeneous networking
- Exploit the capabilities of the new protocols to solve the hard problems of ad hoc networking (e.g., QoS, multicasting, capacity, …)

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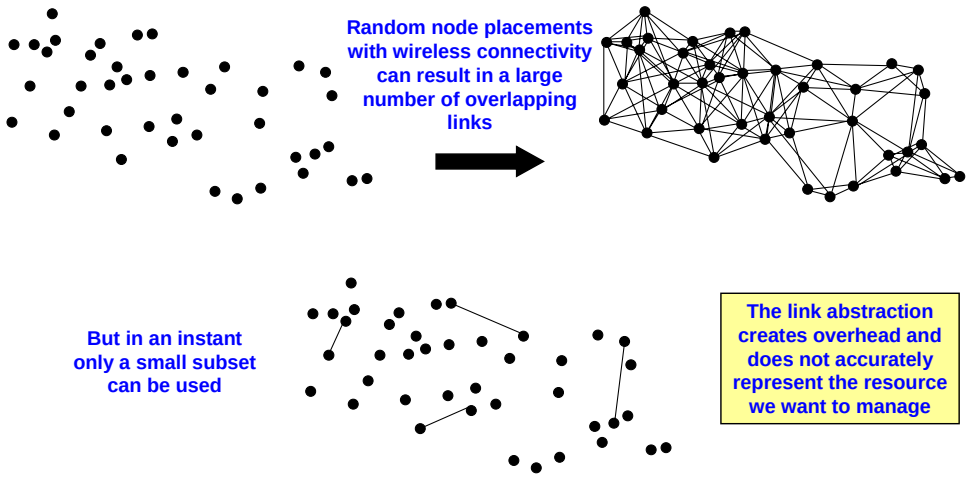
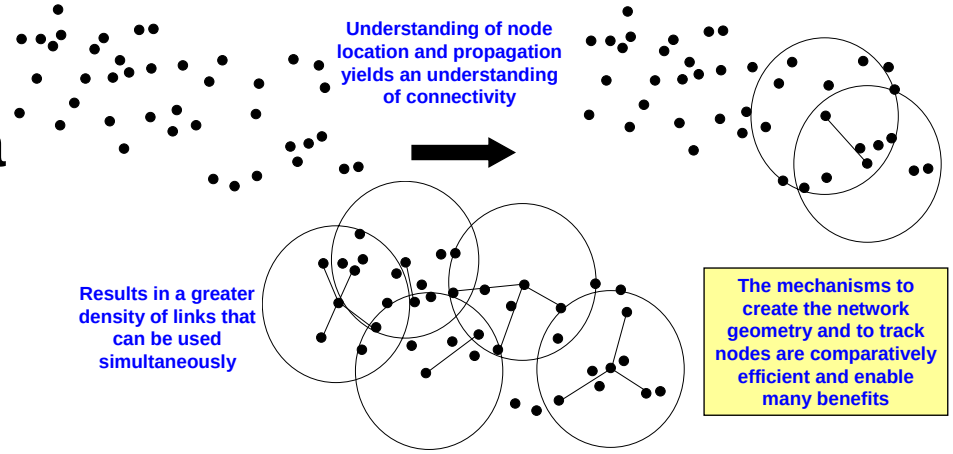
Background

- **Typically MANET research has favored wireline networking approaches**
  - **Access protocols create links**
  - **Routing protocols track links**
- **Our approach favors a wireless view**
  - **Access protocols create a transmitter geometry**
  - **Routing protocols track node states**





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Objectives

- Create a synchronization and geolocation protocol that is integral to the access and routing protocols
- Create algorithms to generate propagation maps and to optimize them for size and accuracy
- Create a protocol that will integrate our wireless networking approach with wireline networks
- Create a complete protocol stack that provides quality of service and multicasting services
- Create a network manager's workstation that enables traffic engineering and spectrum management capabilities

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Activities

- We are creating multiple distributed algorithms for use in mobile ad hoc networks.
- We are creating multiple simulation environments to evaluate and improve our protocols.
  - OPNET simulations for integrated protocol behavior
  - Specialized simulation environments for algorithm development
    - Propagation map creation
    - Propagation map distribution and use
    - Node synchronization and geolocation

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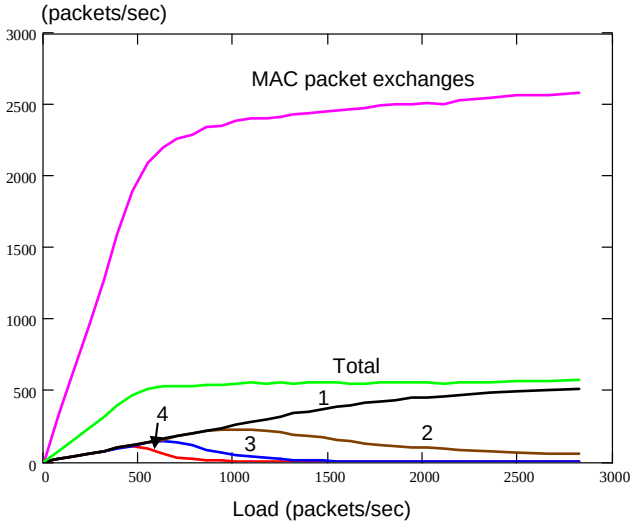
Highlight

- **Our protocols solve many of the hard problems in ad hoc networking, such as quality of service.**

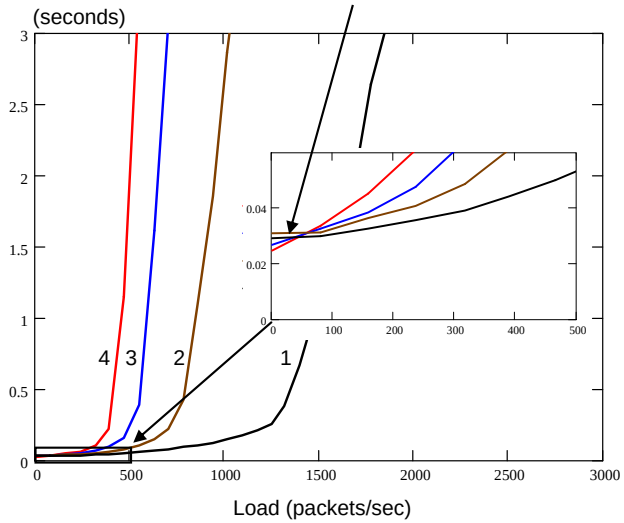
Simulation results illustrating the effectiveness of our prioritized access mechanism

Ideal packet prioritization



End-to-end throughput

Low priority packets not penalized in lightly-loaded networks



End-to-end delay

- **Other services include multicasting, energy conservation, CDMA support, smart antenna support, and traffic engineering.**

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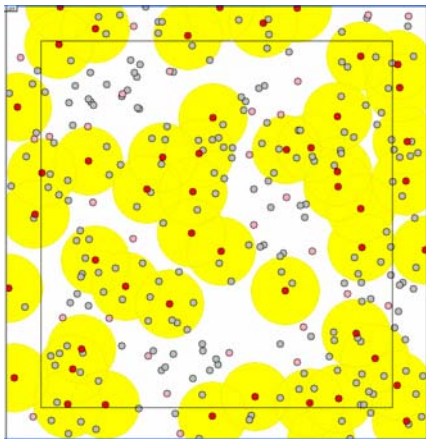
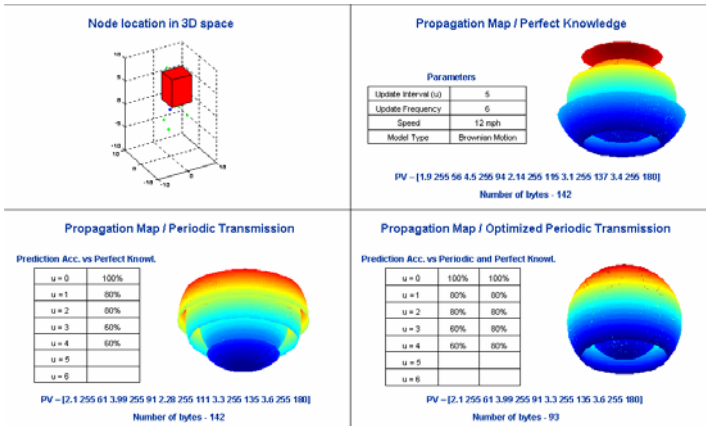
Highlight

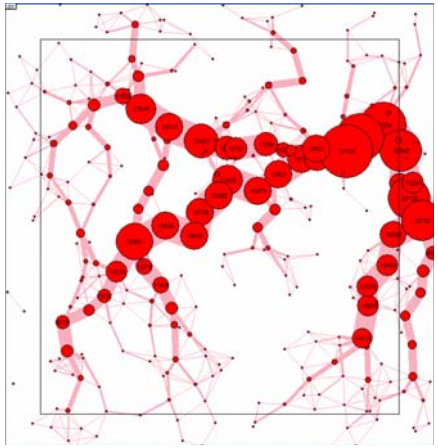
- **We have developed tools to illustrate and study the use of signaling to resolve contention and the use of propagation maps to determine topology.**



Signaling

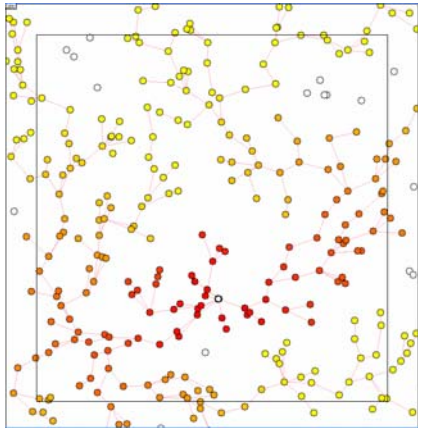
Propagation map development





Topology

Node state dissemination



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Impacts

- Recent papers
  - "A paradigm for quality of service in wireless ad hoc networks using synchronous signaling and node states," *IEEE JSAC Sep 2004*
  - "Exploiting processing gain in wireless ad hoc networks using synchronous collision resolution medium access control schemes," *IEEE WCNC 2005*
  - "Exploiting smart antennas in wireless ad hoc networks using synchronous collision resolution medium access control schemes," *submitted to MobiHOC 2005*
- Contributing to a research proposal to build a wireless modem for ad hoc networking

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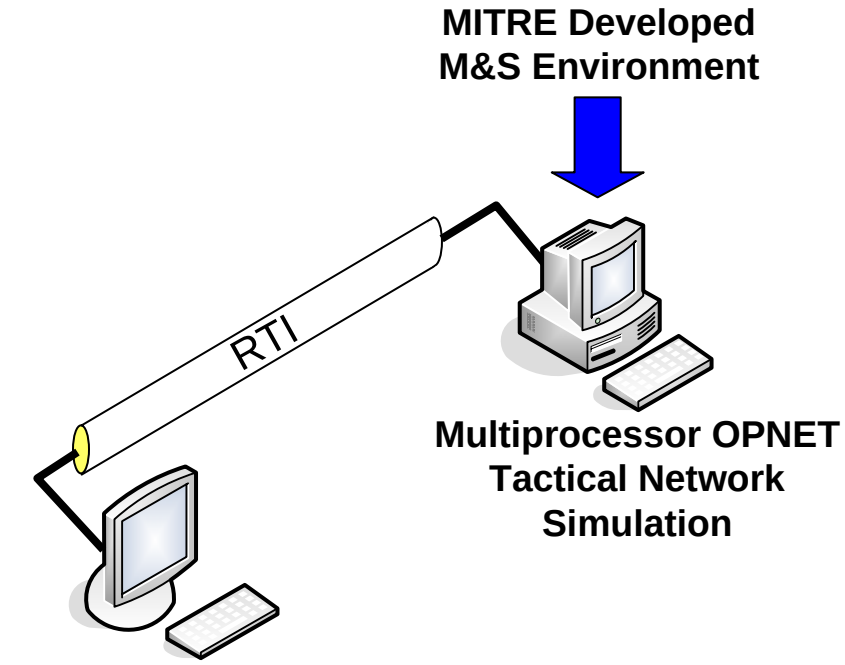
Future Plans

- We envision creating the capability for a human in the loop to interact with the network and improve its performance using traffic engineering, network engineering, and spectrum management tools.



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