CAREER:
Towards Secure Large-Scale Networked Systems: Resilient Distributed Algorithms for Coordination in Networks Under Cyber Attacks

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**PURDUE ENGINEERING**

150 YEARS OF GIANT LEAPS

Description

Components in large-scale cyber-physical networks need to coordinate in order to achieve globally optimal objectives

These components can be compromised by adversaries, causing them to behave maliciously

⬤ Compromised Node (malware, external attack)

⬌ Compromised Communication Link

⬌ Disrupted (DoS) Communication Link

Goal of This Project:

Create distributed coordination algorithms for large-scale networks with provable security and performance guarantees in the presence of malicious nodes

Dynamical System
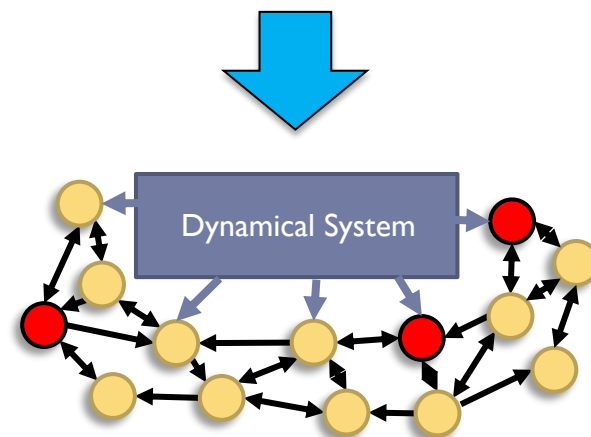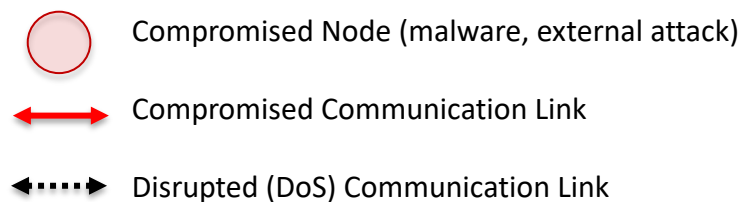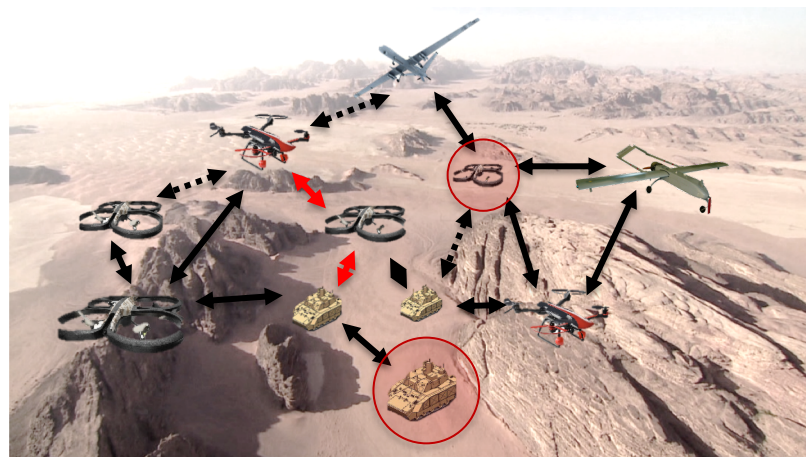
Findings

- Studied two canonical problems: **resilient distributed optimization** and **resilient distributed state estimation**
- **Identified fundamental limitations on achievable performance** under adversarial behavior
- **Created algorithms with provable performance guarantees**, even when network contains a large number of **worst-case (Byzantine) adversaries**
- **Algorithms are scalable** and do not require nodes to know global information (such as network topology)

Our algorithms can tolerate a large number of adversaries

"Off-the-shelf" Distributed Optimization Algorithm (no malicious nodes)

"Off-the-shelf" Distributed Optimization Algorithm (one malicious node)

Our algorithm