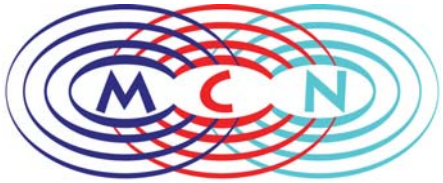

Research Projects in the Mobile Computing and Networking (MCN) Lab

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Mobile Computing and Networking (MCN) Lab

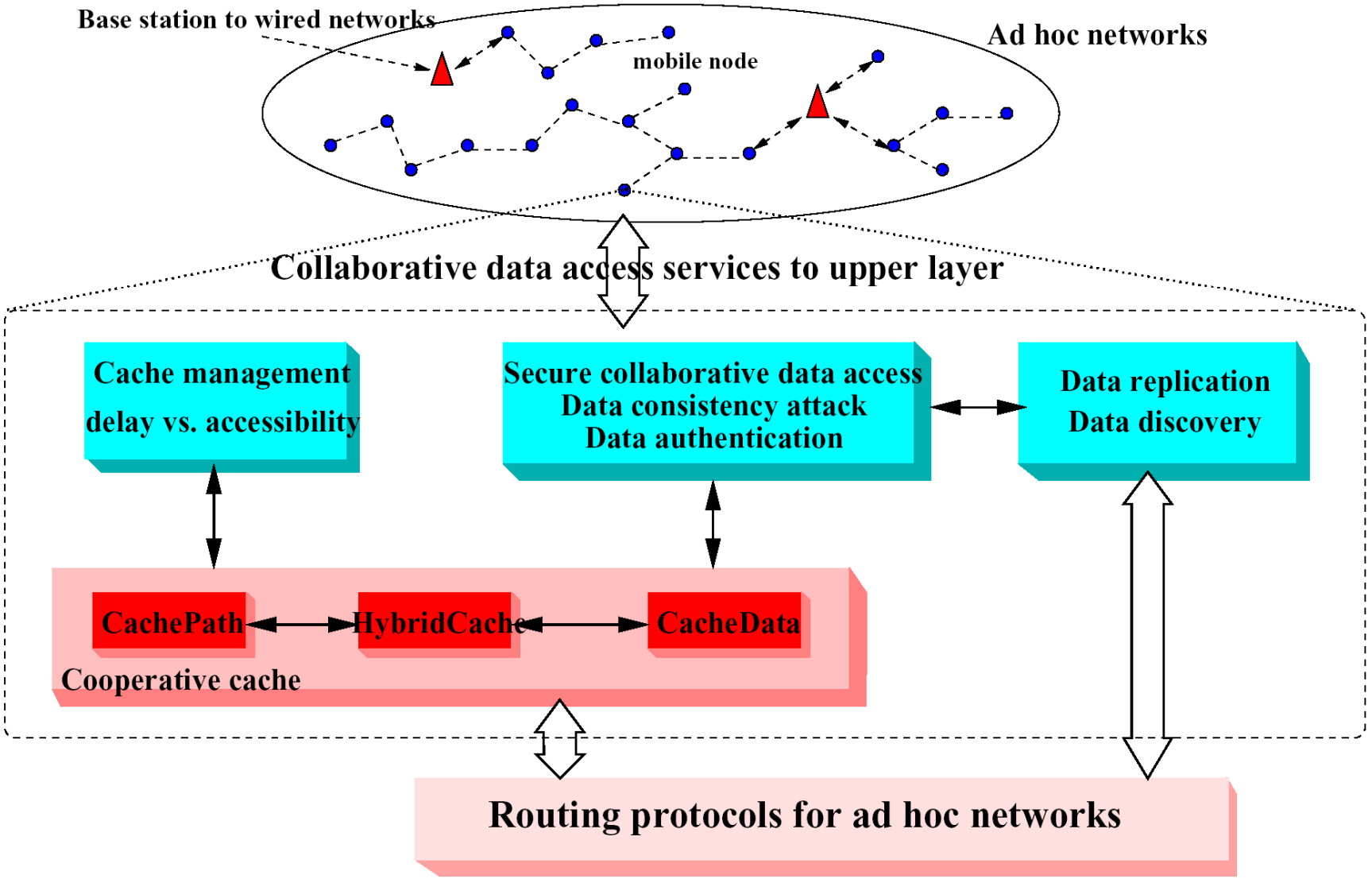
- MCN lab conducts research in many areas of wireless networks and mobile computing, emphasis on designing and evaluating mobile systems, protocols, and applications.
  - Current Projects: wireless sensor networks, vehicular networks, wireless network security, data dissemination/access in wireless P2P networks, resource management in wireless networks.
  - Support: NSF (CAREER, ITR, NeTS, NOSS, CT, CNS), Army Research Office, DoD/Muri, PDG/TTC and member companies Cisco, Narus, Telcordia, IBM and 3ETI.
- Current students: 9 PhD, 2 MS, and 2 honor BS students
  - Alumni: 4 PhD, including faculty members at Iowa State University, Florida International University, and Frostburg State University.
  - 10 MS students went to various companies
- For the last three years: 12 infocom papers, 3 mobihoc paper, 1 mobisys paper, and 40 other papers.

Current Research Projects

- Collaborative Data Access in Wireless P2P Networks (with C. Das)
- Data Dissemination in Vehicular Ad Hoc Networks
- Controllable Node Mobility for Mission-Oriented Sensor Networks (with La Porta, Kesidis, Das)
- ARSENAL: A Cross Layer Architecture for Secure and Resilient Tactical Mobile ad hoc Networks (with La Porta)
- A Framework for Defending Against Node Compromises in Distributed Sensor Networks (with Zhu)
- Security and Privacy support for data centric sensor networks (with Zhu)

Data Access in wireless P2P Networks

- Most of the previous researches in ad hoc networks focus on routing or MAC issues.
- Data access is also very important, since the ultimate goal of using ad hoc networks is to provide information access to mobile nodes.
- In Battlefield, after a soldier obtains enemy information (e.g., battlefield map, enemy distribution) from the commander (data center), it is very likely that nearby soldiers also need the same information.
  - Bandwidth and power can be saved if these data access are served by the soldier with the cached data instead of the data center which may be far away.

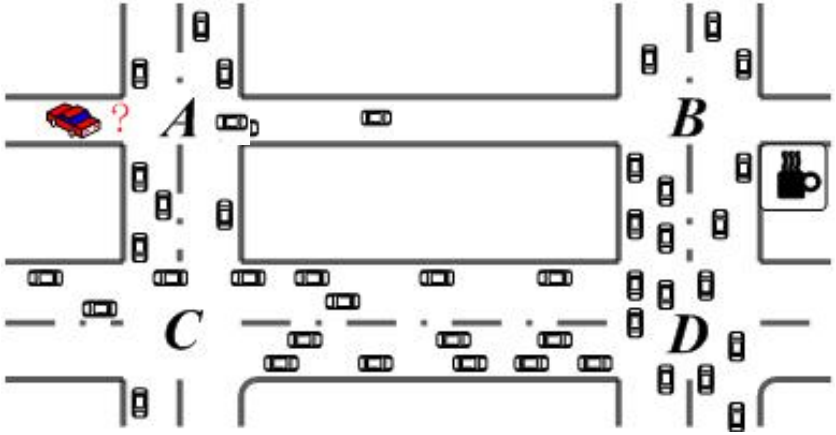

Base station to wired networks
mobile node
Ad hoc networks
Collaborative data access services to upper layer
Cache management
delay vs. accessibility
Secure collaborative data access
Data consistency attack
Data authentication
Data replication
Data discovery
CachePath
HybridCache
CacheData
Cooperative cache
Routing protocols for ad hoc networks

Vehicle Assisted Data Access

- VANET has been envisioned to be useful in road safety and many commercial applications
  - A moving vehicle may want to know the sale information or remaining stocks at a department store or gas station; the available parking lot at a parking place; the room availability and price at a hotel.
- VANET is highly dynamic and may have frequent disconnections. How to access these data using VANET quickly?

Vehicle Assisted Data Access

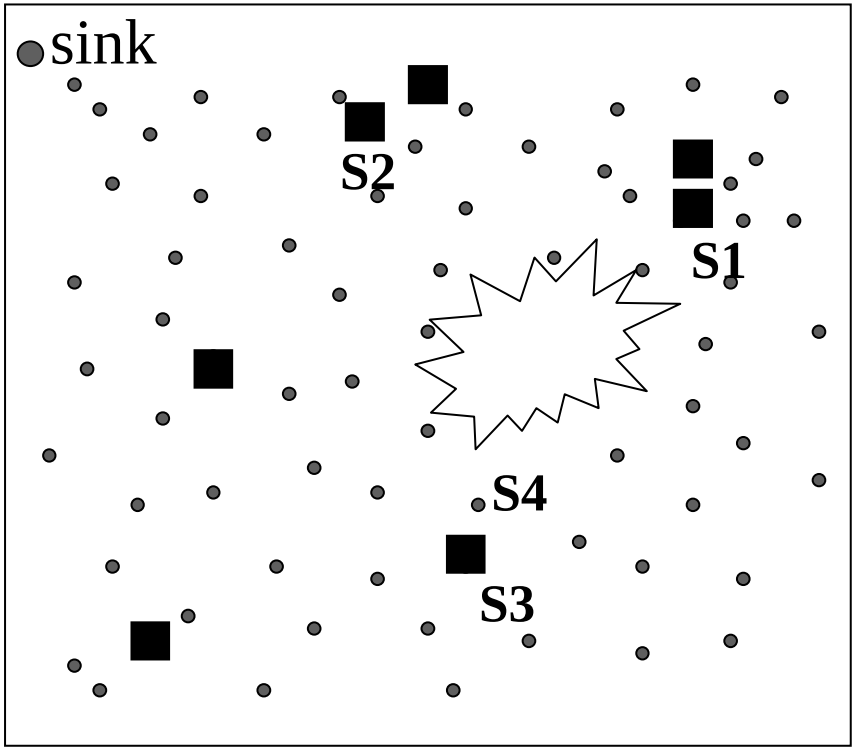
- Solution: Store, carry and forward
- Use predictable traffic pattern and vehicle mobility to assist data delivery
  - Select a forwarding path with smallest packet delivery delay

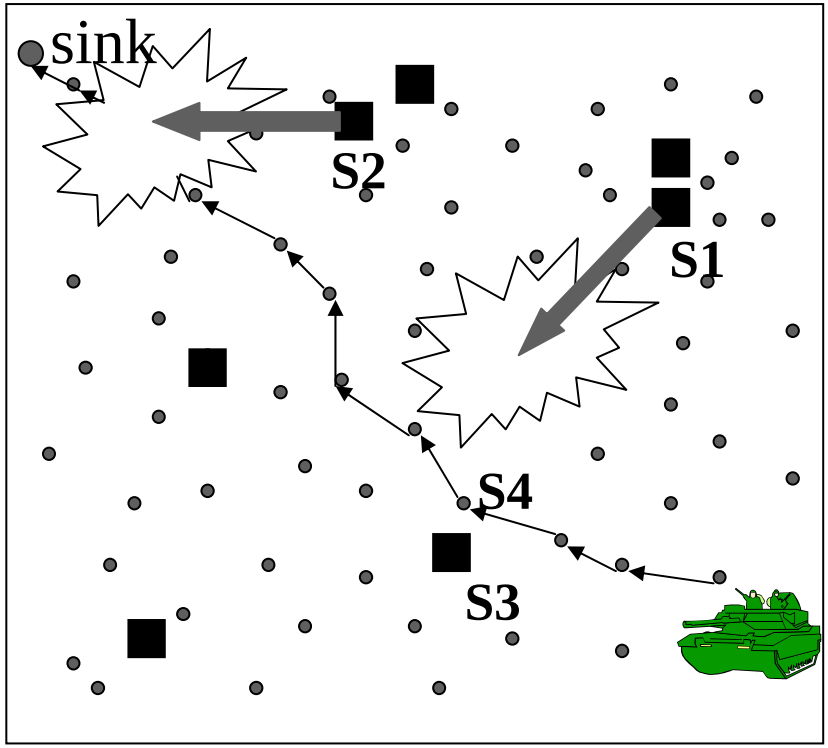


Mission Oriented Sensor Mobility

- Sensor networks can automate information gathering and processing, can support applications such as target tracking, perimeter defense, environmental monitoring, and intelligent transportation.
- Multiple missions, each with different requirements, may share common sensors to achieve their goals.
- Each mission may have its own requirements
  - In perimeter defense, the requirement is to have adequate sensors along a pre-define perimeter.
  - In target tracking, enough sensors should be deployed along the track of the target.
- As the mission changes, nodes may need to move.

Moving sensors to satisfy different mission requirements





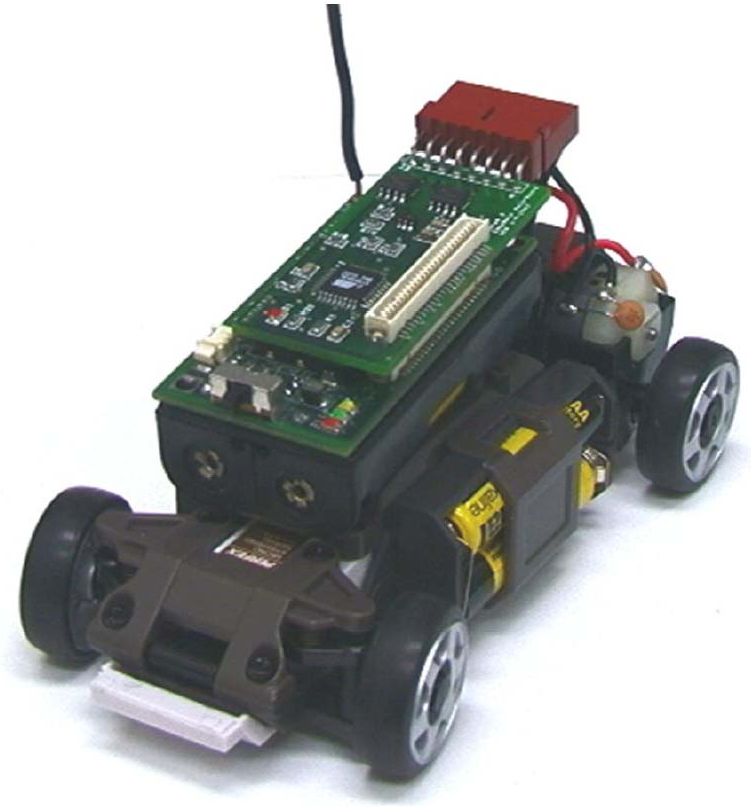
Other reasons such as: sensor failure or new event such as chemical spill, target approaching, sensing obstacle (blocking video sensor or acoustic sensor).

Research Issues

- Mobility assisted sensing: relocate sensors as the network condition changes (sensor failure or new event such as chemical spill, target approaching).
- Network monitoring: detect node failures and estimate the loss of coverage.
- Mobility assisted data dissemination (routing): moving sensors to improve network communication; increasing network lifetime, dealing with network partition.
- Integrated mobility management for sensing and routing: define utility functions that can capture the benefits of the movement from the perspective of all missions (e.g., routing or sensing).

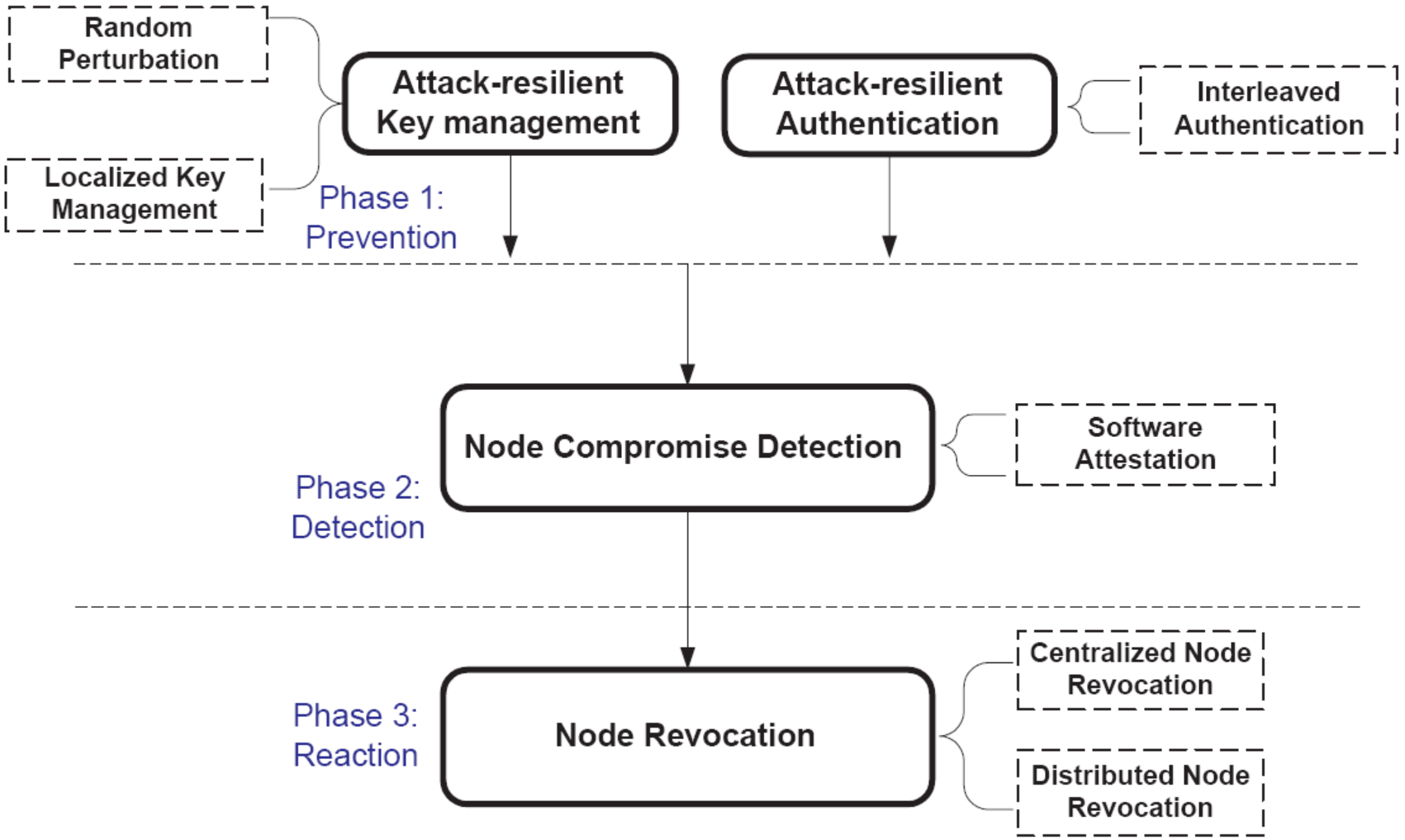
Evaluations

- Currently evaluate with *ns*.
- Considering prototype with commercial off-the-shelf component. Each robot is small (5” x 2.5” x 3”) and costs under $200 each
- Mobility, built from remote-controlled toy cars.
- Runs TinyOS, based on Berkeley Mica Motes, has processor and wireless communication.



Secure Sensor Networks

- It is a big challenge to secure wireless sensor networks because of the network scale, the highly constrained system resource, and the fact that sensor networks are often deployed in unattended and hostile environments.
- We propose to develop a framework for defending against node compromises in unattended sensor networks. The framework consists of a suite of security mechanisms spanning three phases:
  - prevention
  - detection
  - reaction
- This research will provide fundamental security services covering key management, authentication, compromise detection, and revocation.



A Framework for Defending Against Node Compromises in Distributed Sensor Networks