

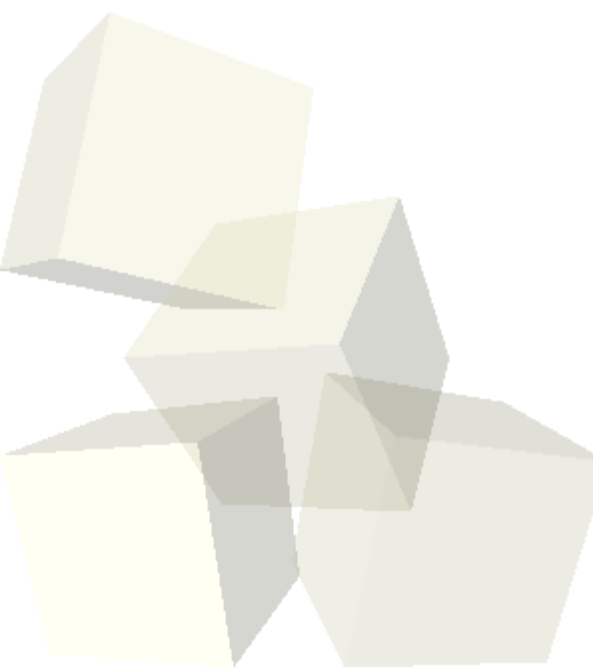
Self-Organization Algorithms in Wireless Sensor Networks with Mobile Nodes

Joseph Violi

Supervisors

Ahmet Sekercioglu

Andrew Price



Self-organization

- ♦ Allows a system to configure/organize itself without external management or direction.
- ♦ Useful when system is too large/complex for manual configuration
- ♦ Good for time varying systems

Wireless Sensor Networks (WSNs)

- ♦ Consist of many nodes (large/complex system)
- ♦ Usually used to monitor physical/environmental parameters
- ♦ Nodes have limited processing/memory/energy
- ♦ Node failures are expected (time varying)

Self-Organization in WSNs with Mobile Nodes

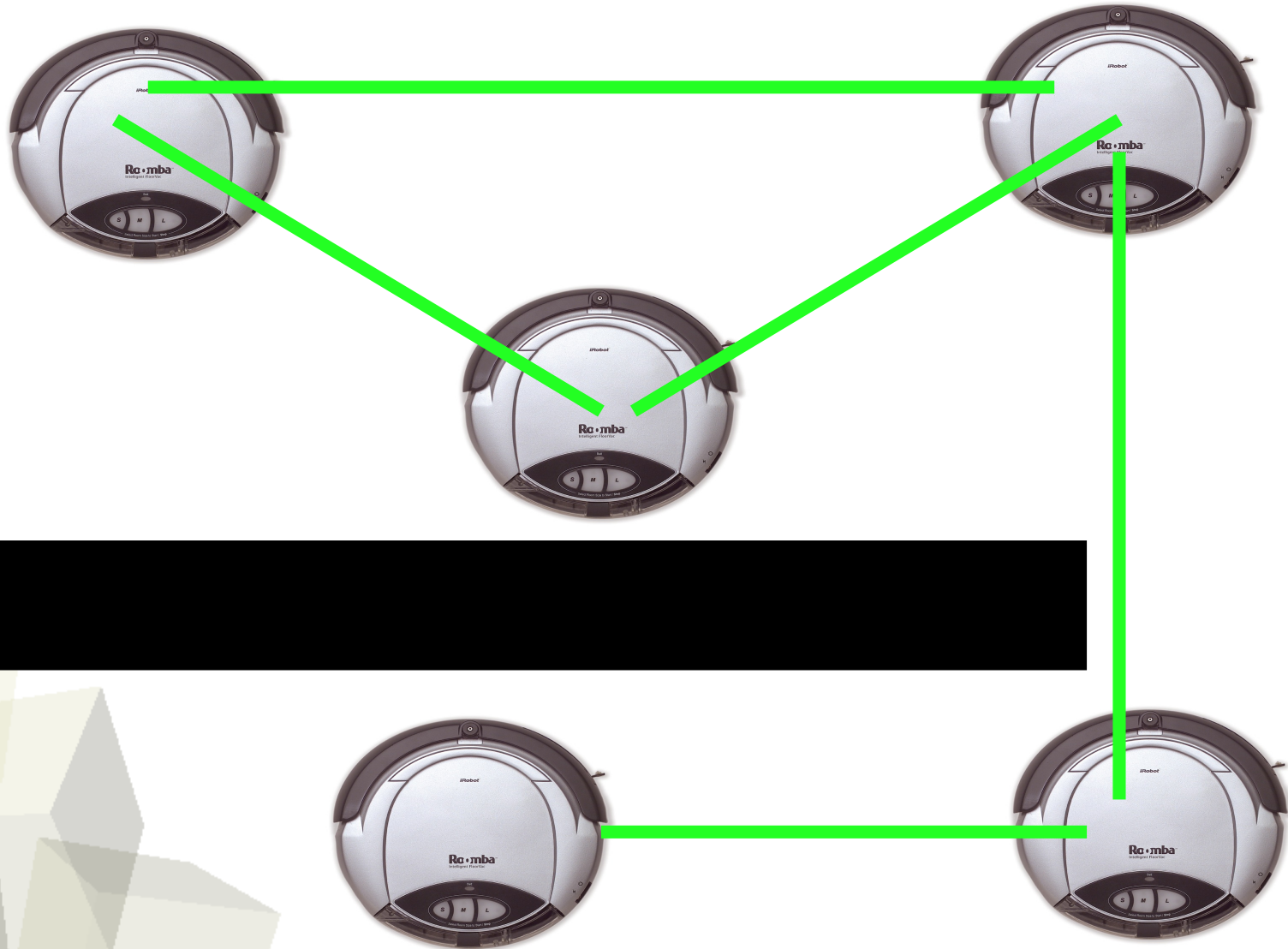
- Self-organization algorithms allow the nodes to **automatically configure themselves** and respond to changes in their environment

Our focus is WSNs with mobile nodes

- Advantages of mobile nodes in WSNs
 - ♦ Nodes can physically move to repair the network[1]
(topology control)
 - ♦ Nodes can move to take readings at different locations[2]
 - ♦ Nodes can move to minimize transmission power
 - Saves energy [3]
 - Reduces interference between nodes [3]
 - Increases overall capacity of WSN [4]

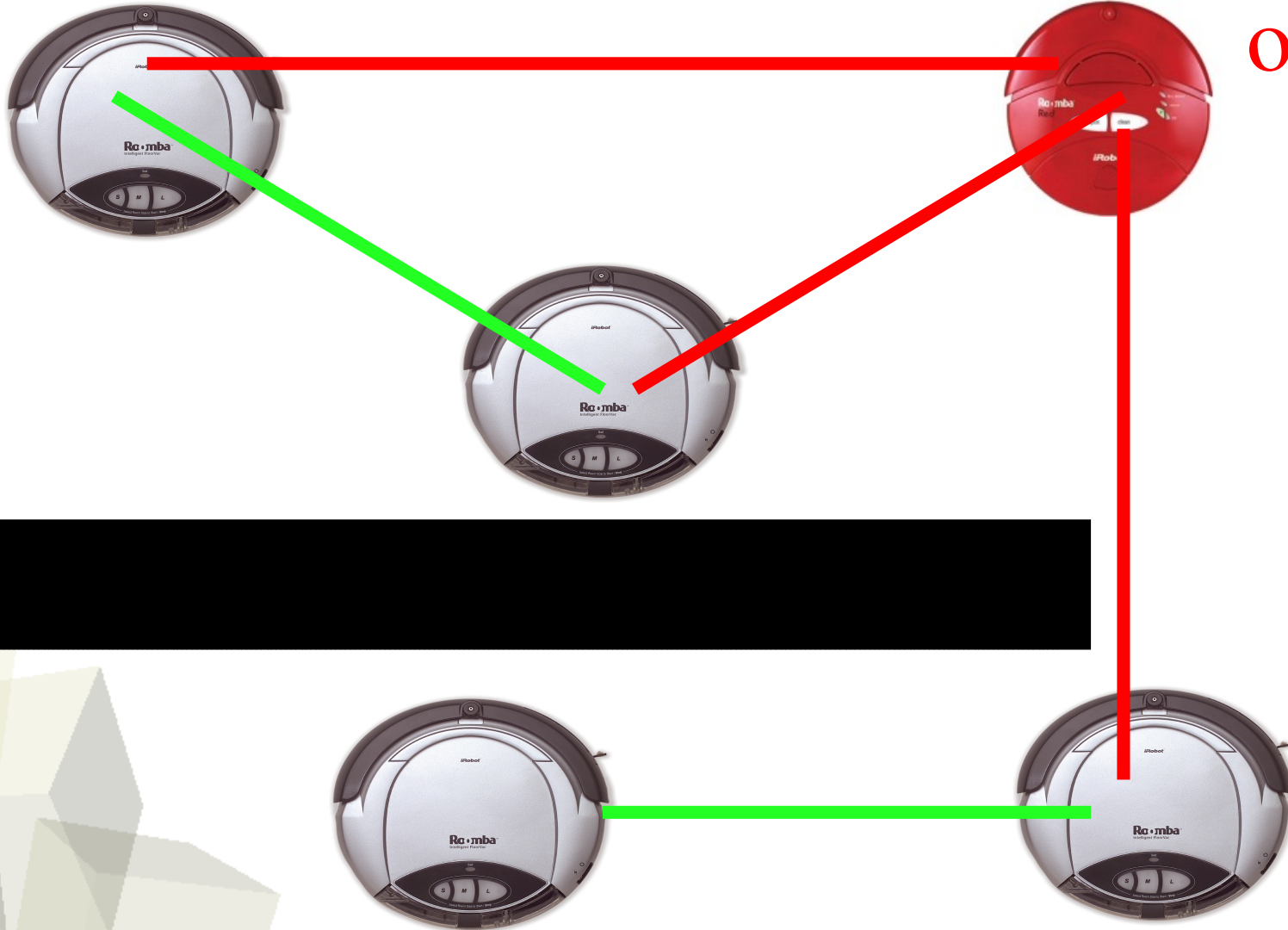
Topology Control Example

All nodes connected

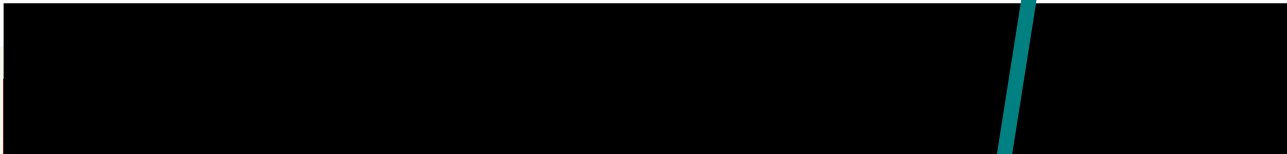


Topology Control Example

Node out of range
or fails

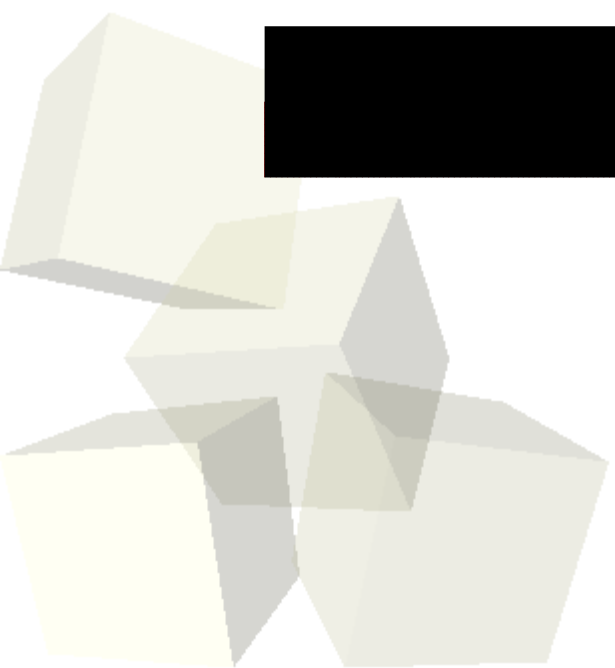
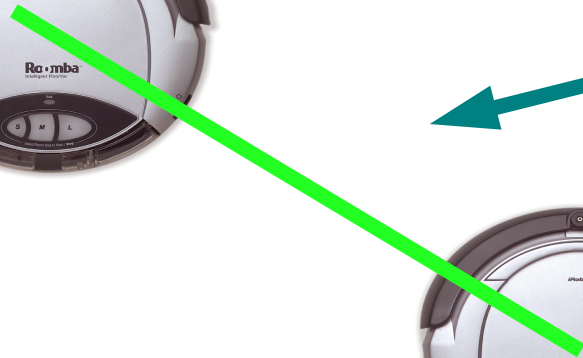


Topology Control Example



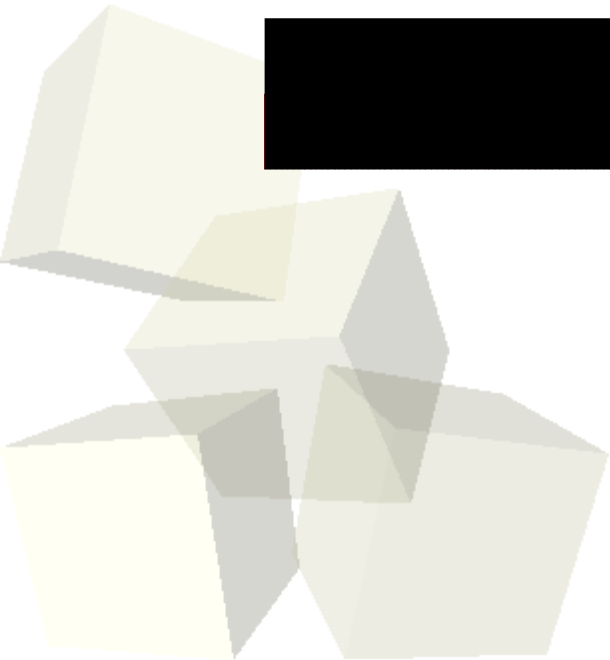
2 Separate Networks!

Algorithms must be scalable - No global map is made by individual nodes.



Topology Control Example

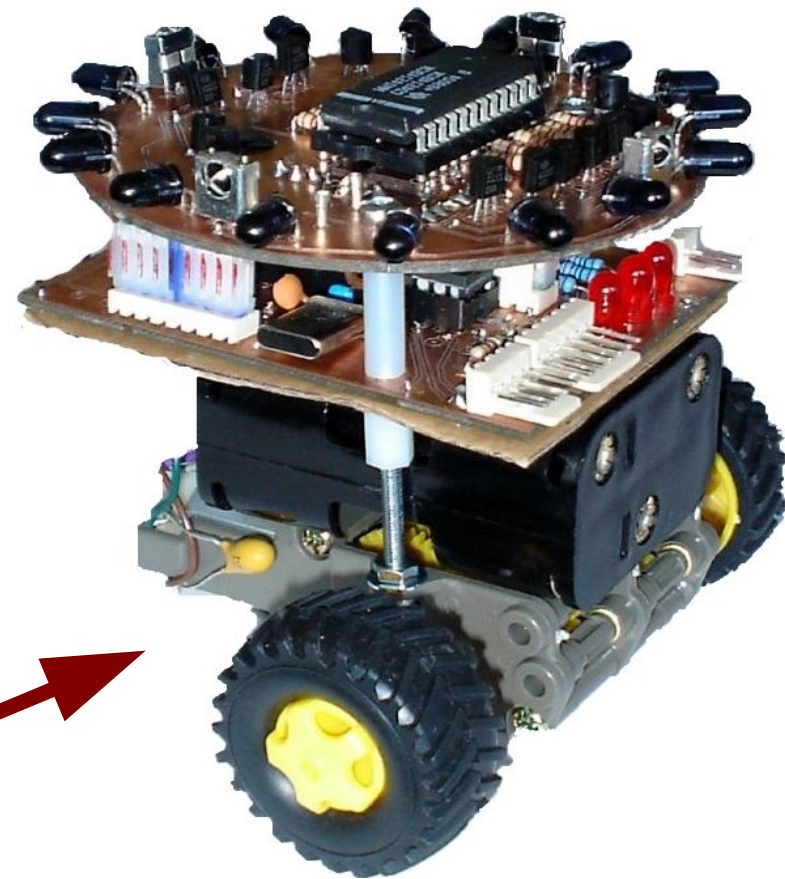
Nodes automatically reorganize themselves



A Testbed for Performance Studies

Project Aims

- Test and compare new and existing algorithms for:
 - ◆ Self organization
 - ◆ Localization
 - ◆ Connectivity maintenance
 - ◆ Power efficiency
- Using cheap nodes
 - ◆ Physical testbed (complemented with simulation)
- Infrared communications
 - ◆ Good for short range (room size) communication
 - ◆ Doubles as relative localization system



Future Plans

Possible Future Plans

Extend self-organization algorithms to Unmanned Aerial Vehicle (UAV) platforms



[Dr Price's UAV](#)

References

- [1] M. Smith and B. Freisleben, “**Self-healing wireless ad hoc networks based on adaptive node mobility**”
- [2] Y. Gu et al., “**Data harvesting with mobile elements in wireless sensor networks**”
- [3] M. Krunz et al., “**Transmission power control in wireless ad hoc networks**”
- [4] M. Grossglauser and D. Tse, “**Mobility increases the capacity of ad hoc wireless networks**”