Comparison of Routing Protocols for Data Fault Tolerance in Sensor Networks

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Why data fault-tolerance?

- Sensor networks are used in:
  - Life critical applications
  - Battle field scenarios
  - Intrusion detection
- Goal: Accurate measurement and observation in the face of data faults.
- Data faults are the results of:
  - Natural sources (Failures of nodes or links)
  - Malicious sources
    - Electromagnetic jamming techniques
    - Masquerading nodes

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Fault Masking instead of Error Correction

- Error control code /ARQ
  - Inappropriate in high error rates scenarios
  - Wastes energy in transmitting extra bits
- Use error masking
  - Sending multiple copies at the source and undertaking voting at the sink node
- Examine error masking with three protocols: broadcast, gossip, and directed diffusion
- Performance metrics: reliability, convergence time, and energy consumption

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Simulation Parameters

- Failure Mode
  - Transient link failure with 5% probability of failure at each transmission
- Static placement of nodes in a regular grid
- Directed diffusion has a 90^{o} funnel and sense of direction is perfect

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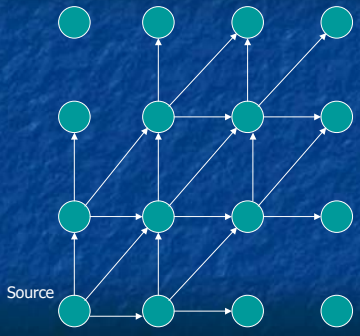
Directed Diffusion



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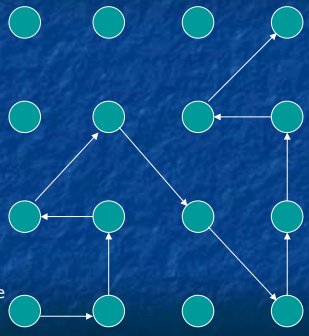
Gossip



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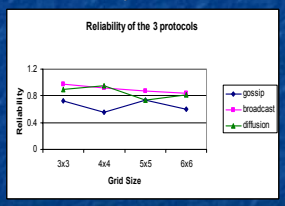
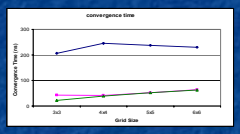
Simulation Results

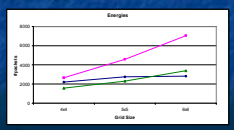
- Reliability



- Convergence Time



- Energy in packets sent



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Conclusion

- Error Masking makes sense in sensor networks
- Between error masking schemes, directed diffusion is more suitable in a sensor network environment

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Future Work

- Topologies
  - Different topologies
  - Irregular topologies
- Voting schemes could be varied
- Nodes with inexact sense of direction
  - What fraction of such nodes could directed diffusion tolerate?

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