

CS 525M – Mobile and Ubiquitous Computing Seminar

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Directed diffusion: a scalable and robust communication paradigm for sensor networks.

- Directed diffusion: a scalable and robust communication paradigm for sensor network.
 - Written by Chalermek Intanagonwiwat, Ramesh Govindan and Deborah Estrin
 - Proceedings of the 6th annual international conference on Mobile computing and networking
 - Written in 2000

Sensor Networks

- Small cheap sensors that can be used directly where a phenomenon is occurring.
 - Need to be cheap and small
 - Have strict power requirements.
- Advantages of theoretical sensor networks
 - Can be closer to what they are observing
 - Requires less complex algorithms to separate what is happening in what they are observing
 - Easier to deploy, especially in hostile environments.

Motivation

- The authors of this paper sought to create a wireless protocol that would be efficient for use in a sensor network.
 - Needed to be able to send packets in a manner more efficiently than relying on broadcast.
 - Hope to provide a reasonably reliable method on sending information.
 - Needs to be robust against failures.

More traditional approach

- More traditional sensor networks rely on one of two strategies:
 1. Large sensing systems that are far away from what they are studying.
 - Could require much greater computational power than a network of small sensors
 2. Small sensors that send the time series of the observed phenomenon
 - Requires sending a lot of data
 - Makes large networks impractical
 - Makes the sensors use a lot of power, limiting their battery life.

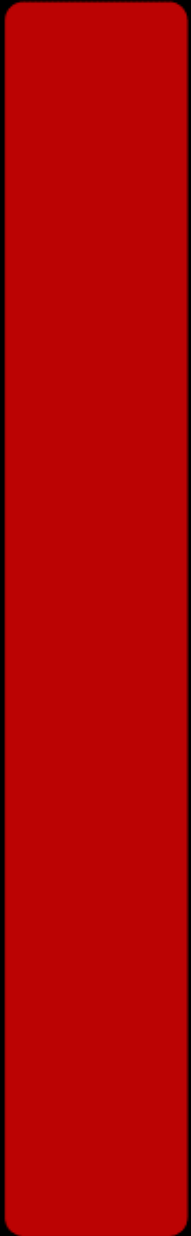
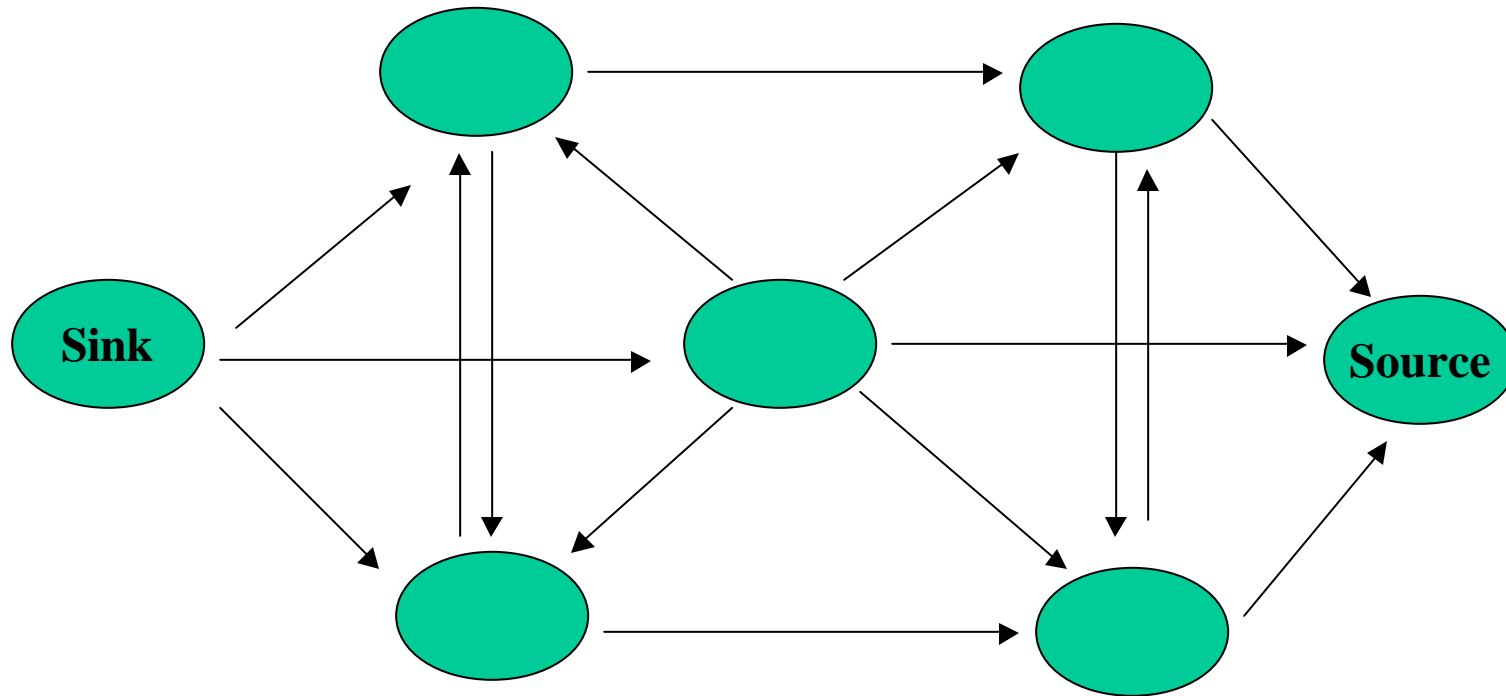
The Concept

- Build sensors that send have the computational power to interpret the data observed at the node.
 - Send smaller pieces of data that indicate the presence of the phenomenon that is being searched for.
 - Attempt to find a data transmission method that allows the network to create an ad-hoc network that can transmit the data efficiently, while not having much overhead for maintaining the network.

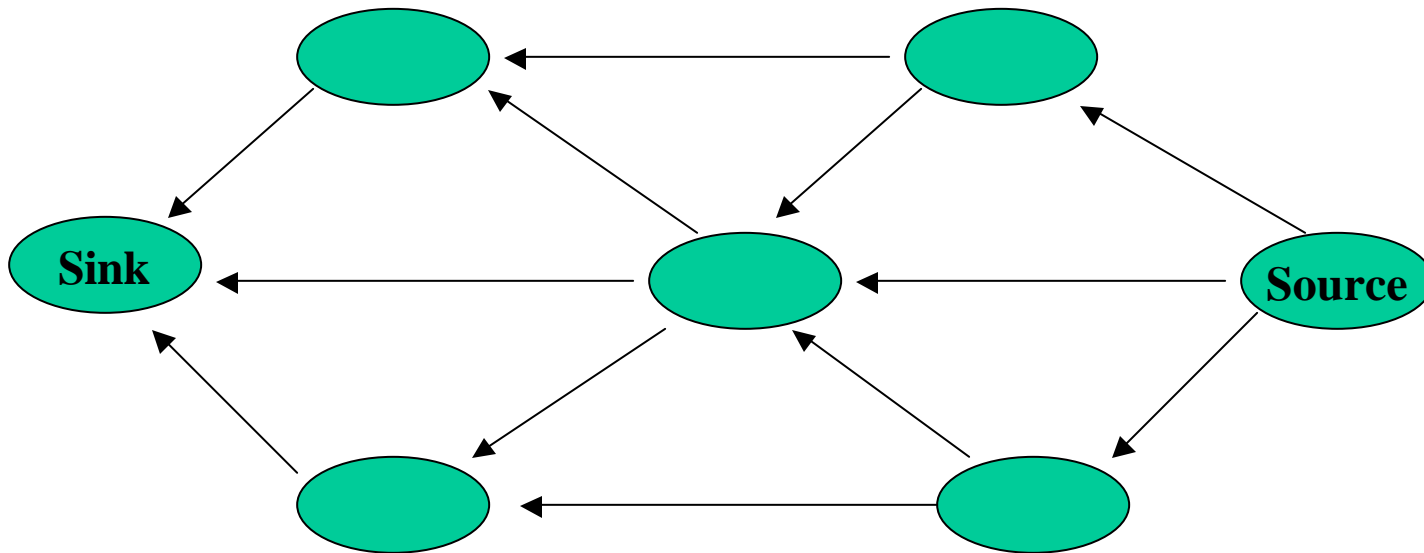
Potential Weaknesses

- No guarantee of packet delivery.
 - No Ack's to insure data gets from one node to another
 - Could get no copies of a certain piece of data, or could get many copies of a piece of data.
 - Need to know what you are studying in advance because you lose the raw data.

Concept

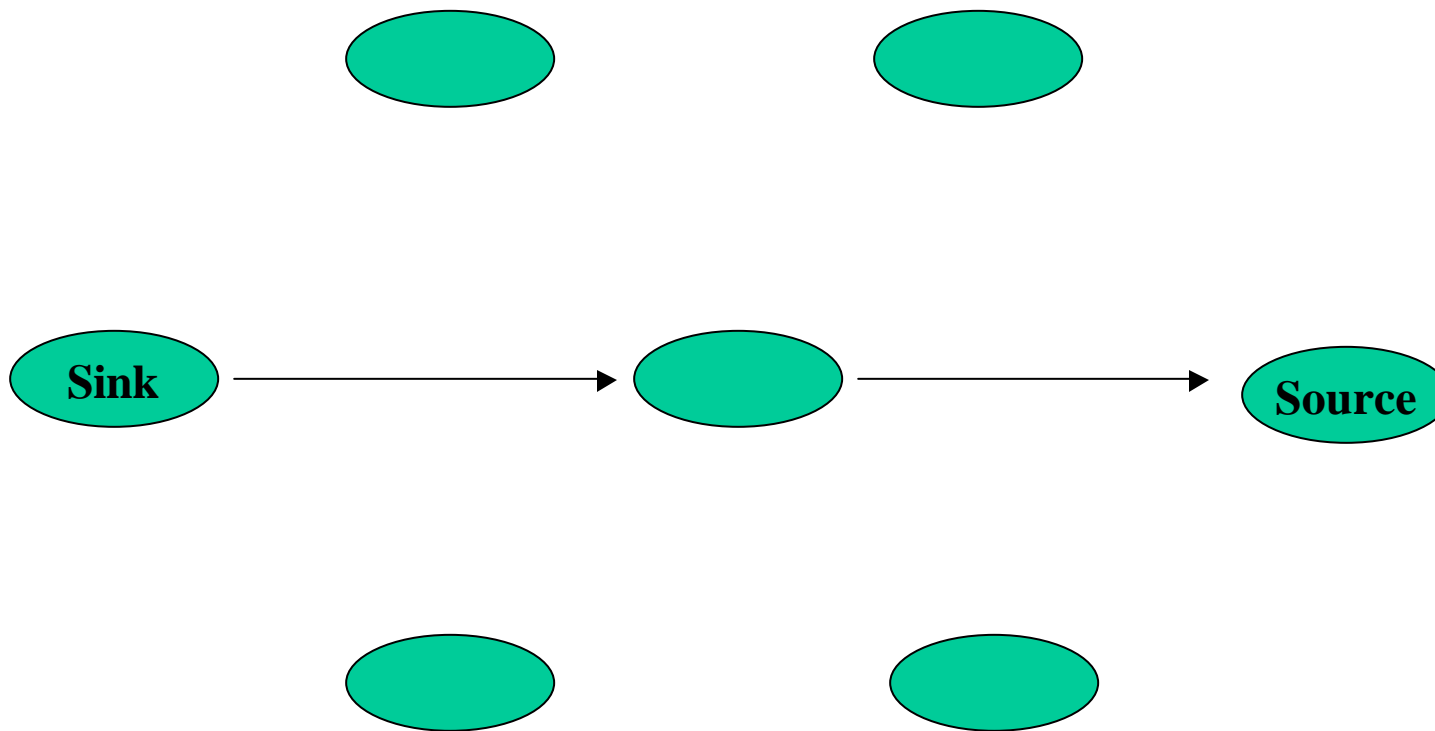


The return path



Leaving out some lines for neatness sake

Request more frequent updates

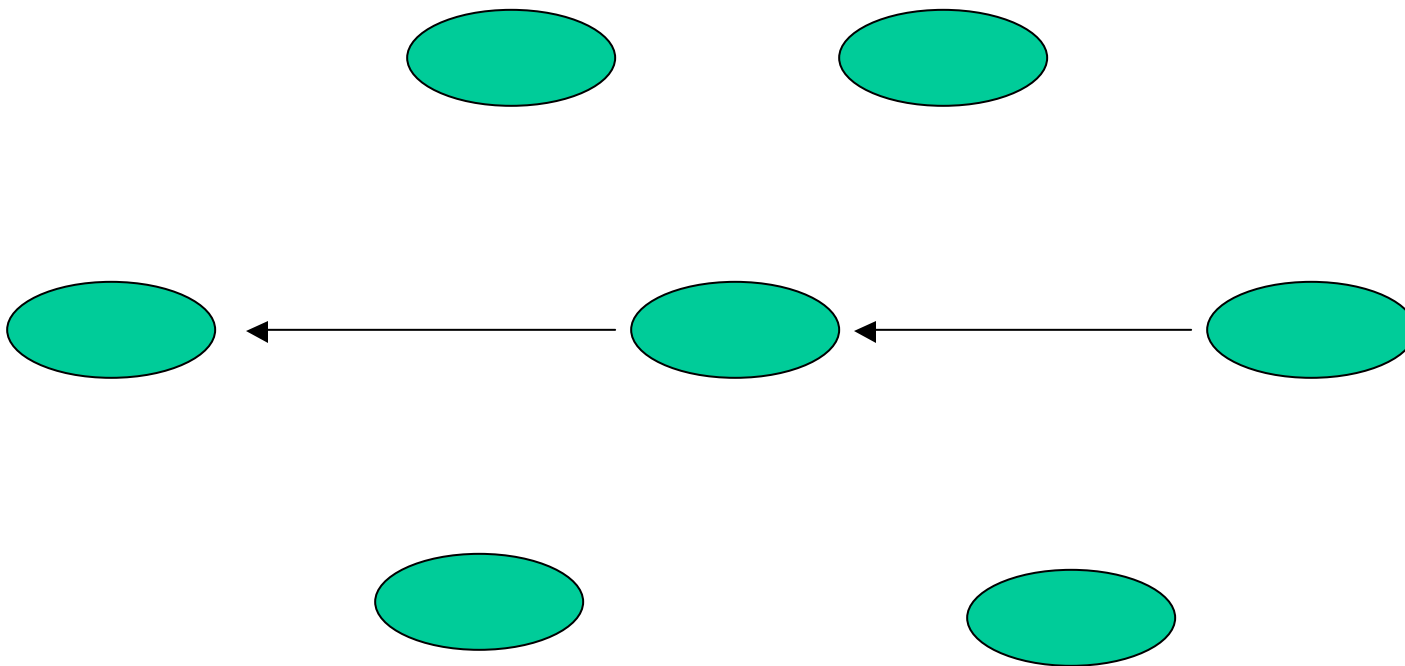


Received event from center node first, request frequent updates.

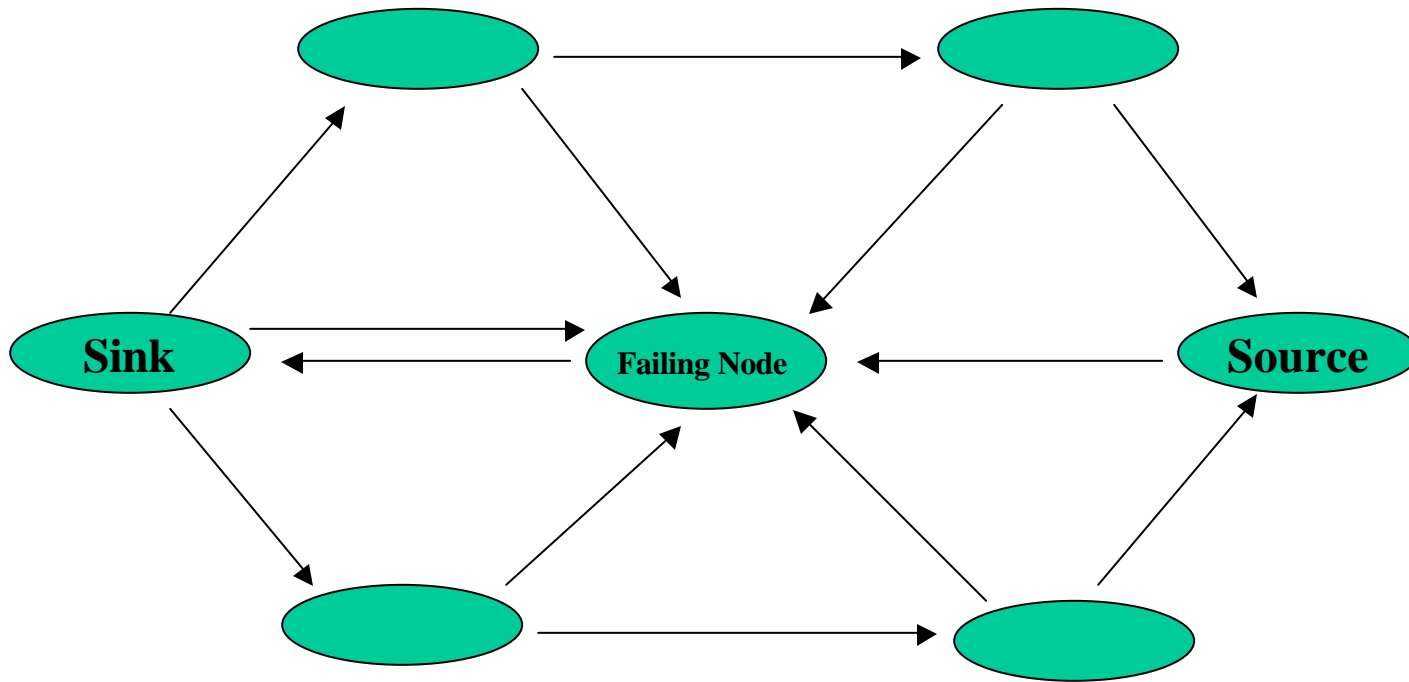
Center node received event from Source node first, request frequent updates.

Idea

- Hopefully leads to frequent updates along shortest path.



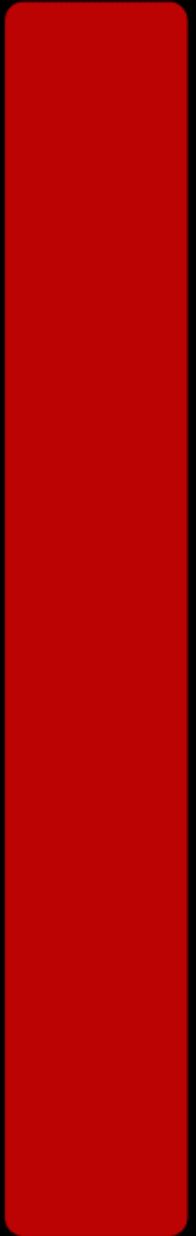
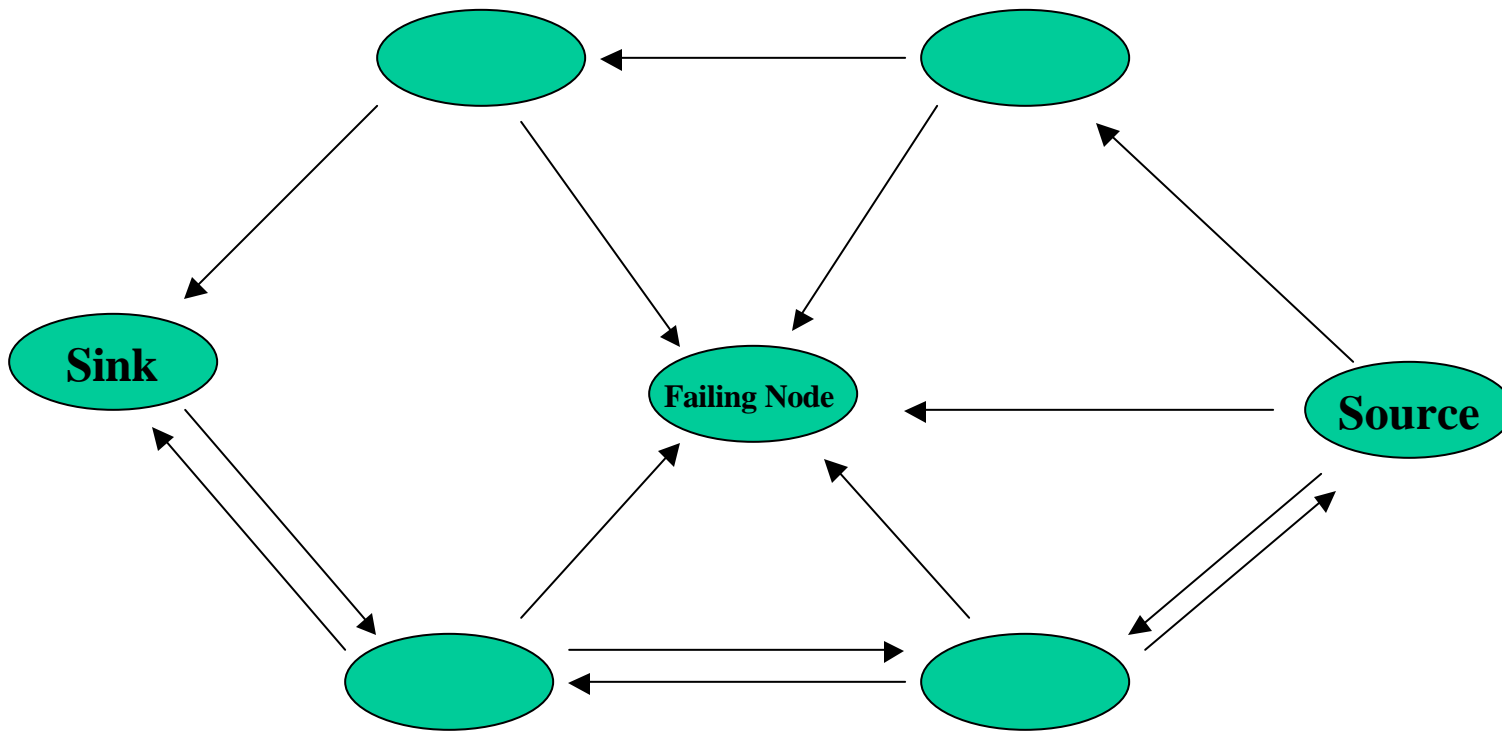
Node failures



1. Node fails

2. Node rebroadcasts interest

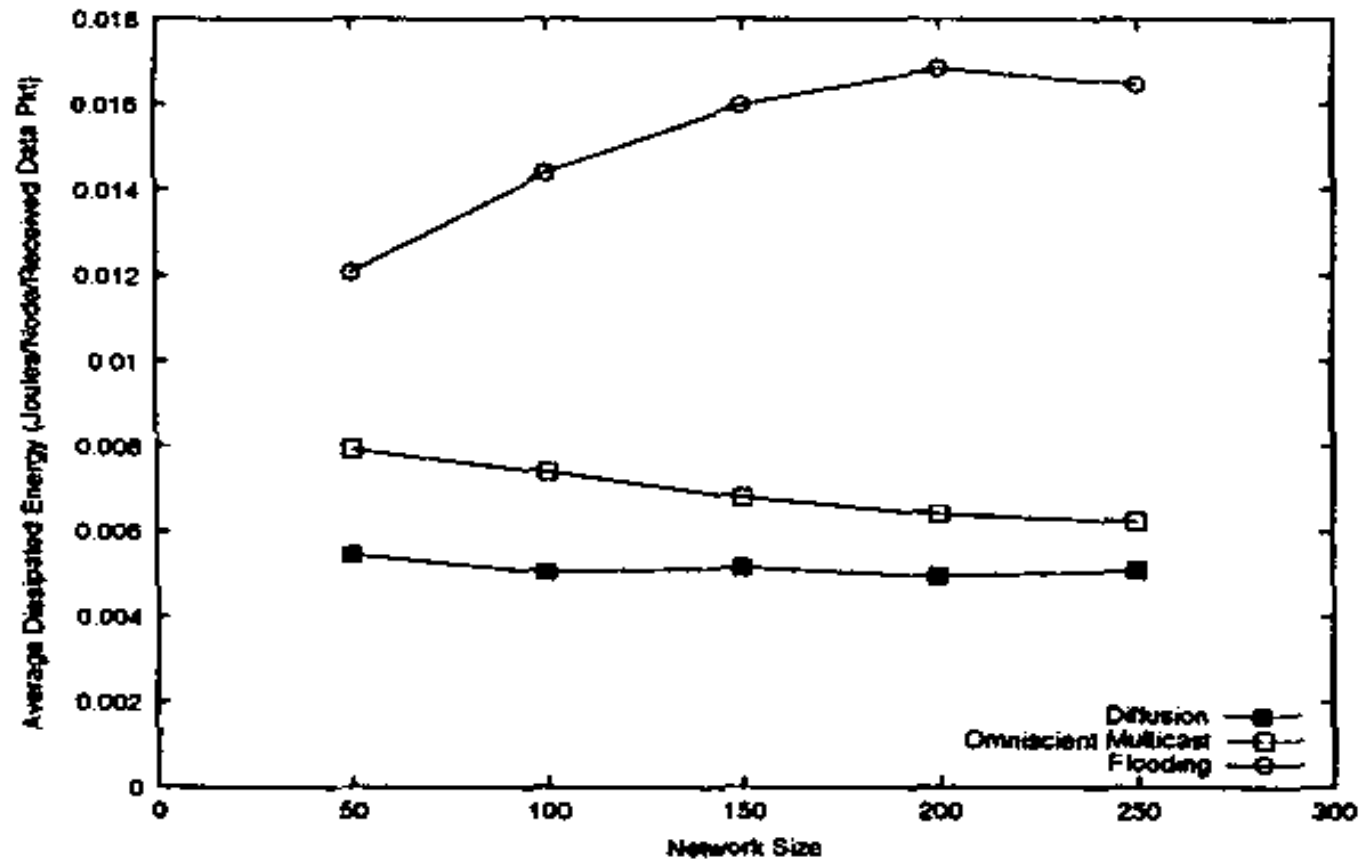
Recovery Continued



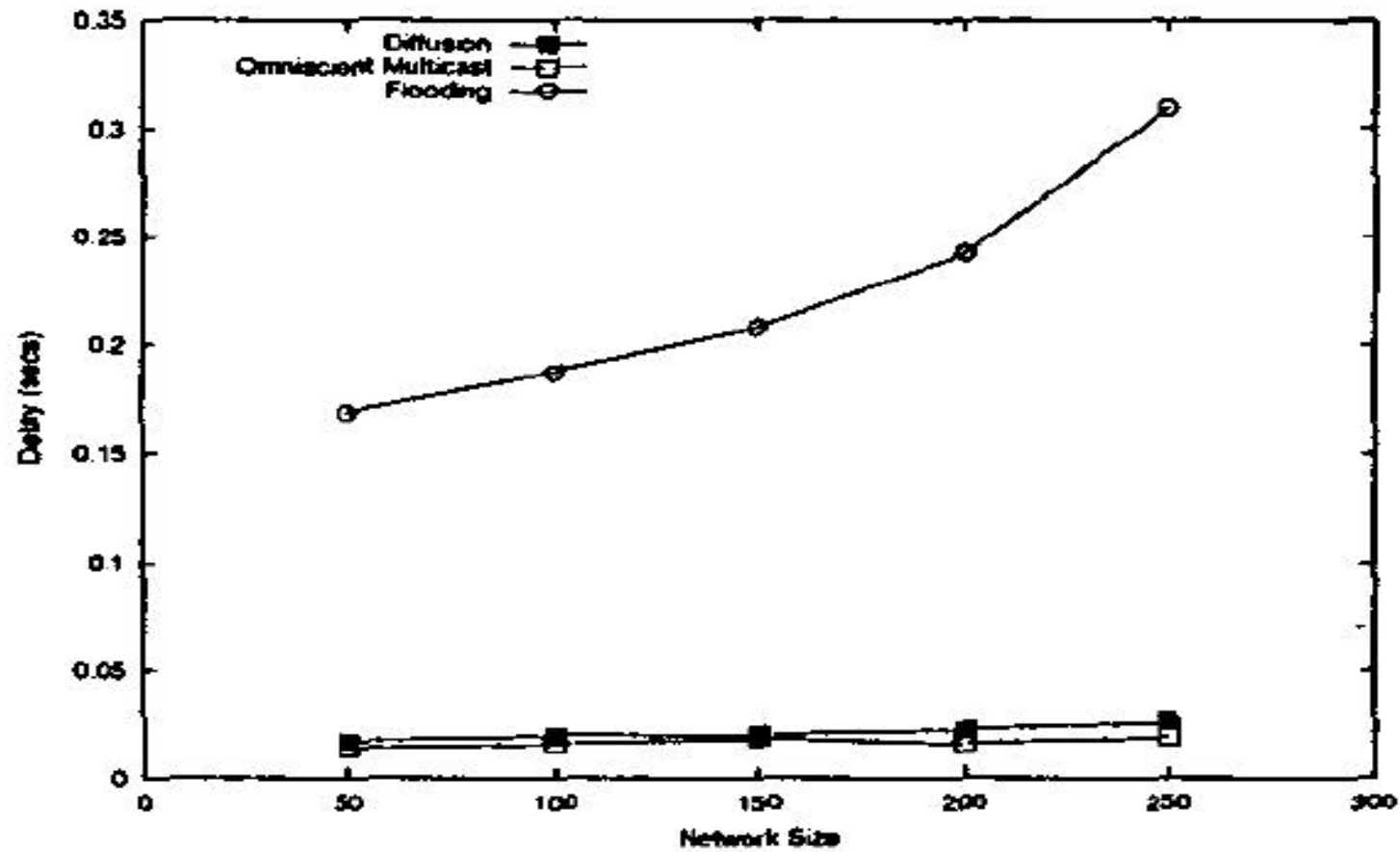
More Information

- Not inconsistent with multiple data sources, and multiple requestors of information, sinks. It simple performs the same process for multiple requests.
- Should be robust to network failures.

Results

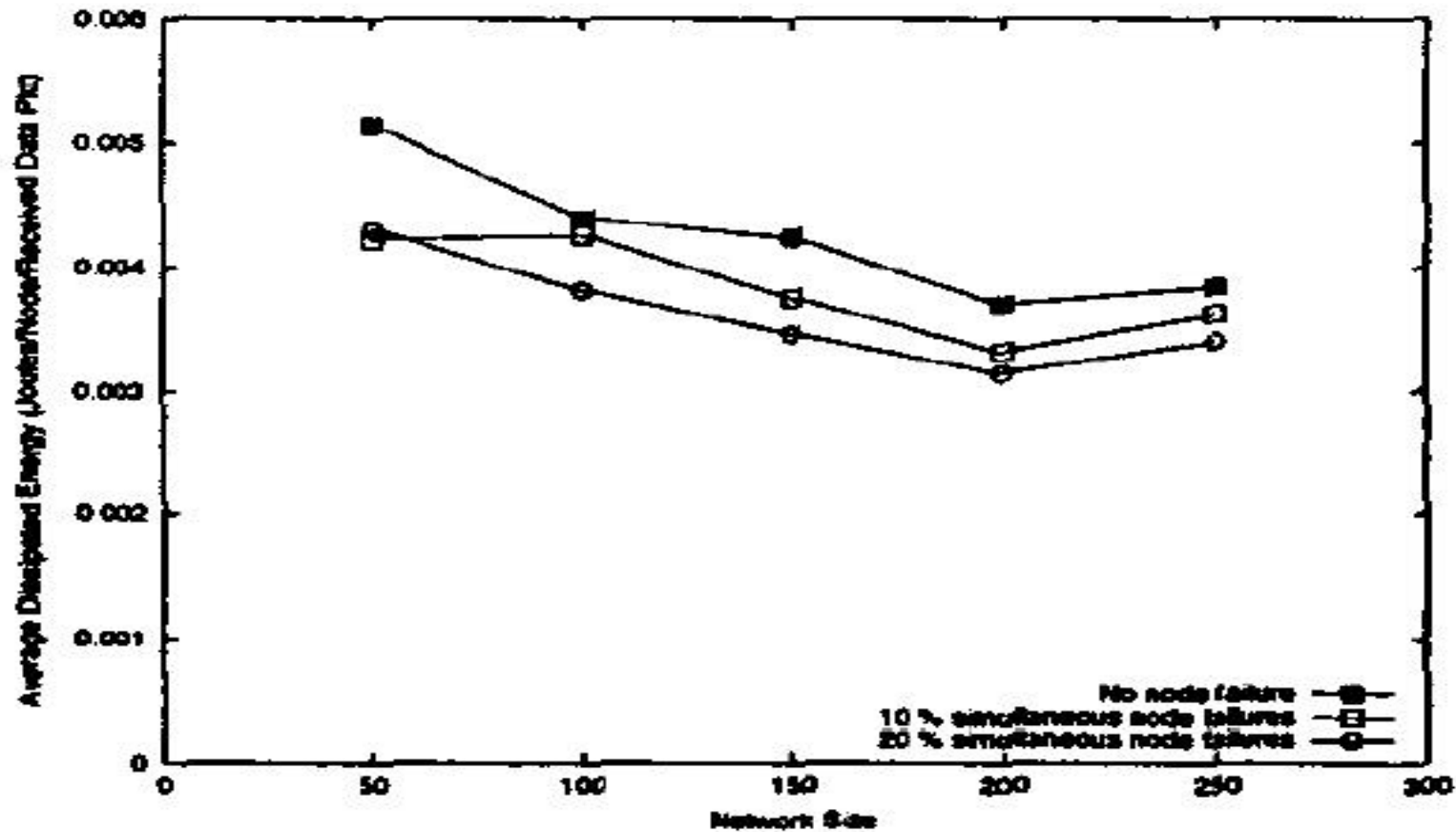


(a) Average dissipated energy



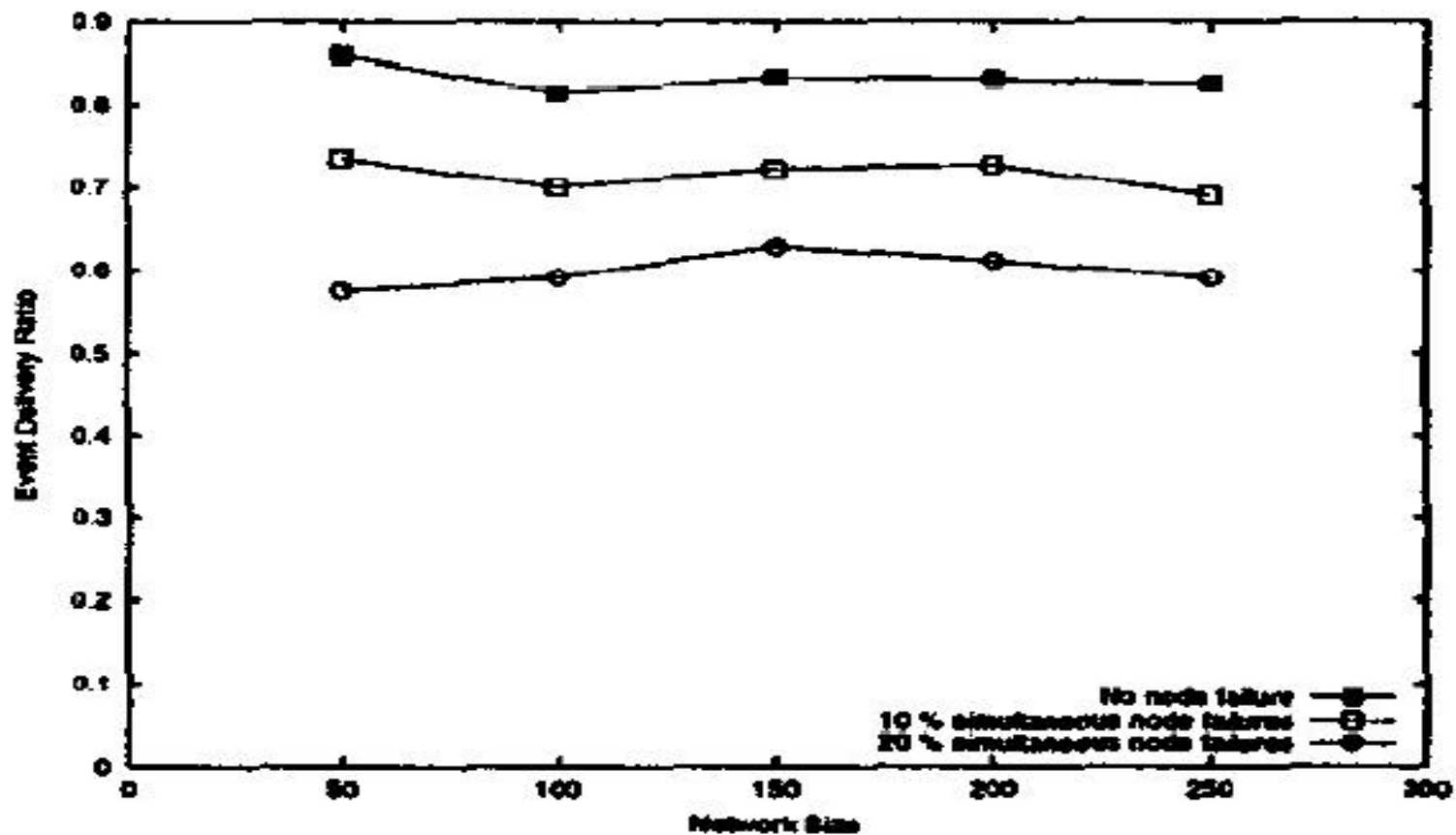
(b) Average delay

More Results



(a) Average dissipated energy

More Results



(c) Event Delivery Ratio

Conclusions

- Data Diffusion can result in a significant savings in energy usage.
- There are limitations
 - Relies on broadcast to form the network and if something goes wrong
 - Still may not be practical in a large sensor network
 - No guaranties on Quality of Service.