



CS649

Sensor Networks

Lecture 20: Routing III

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<http://hinrg.cs.jhu.edu/wsn06/>



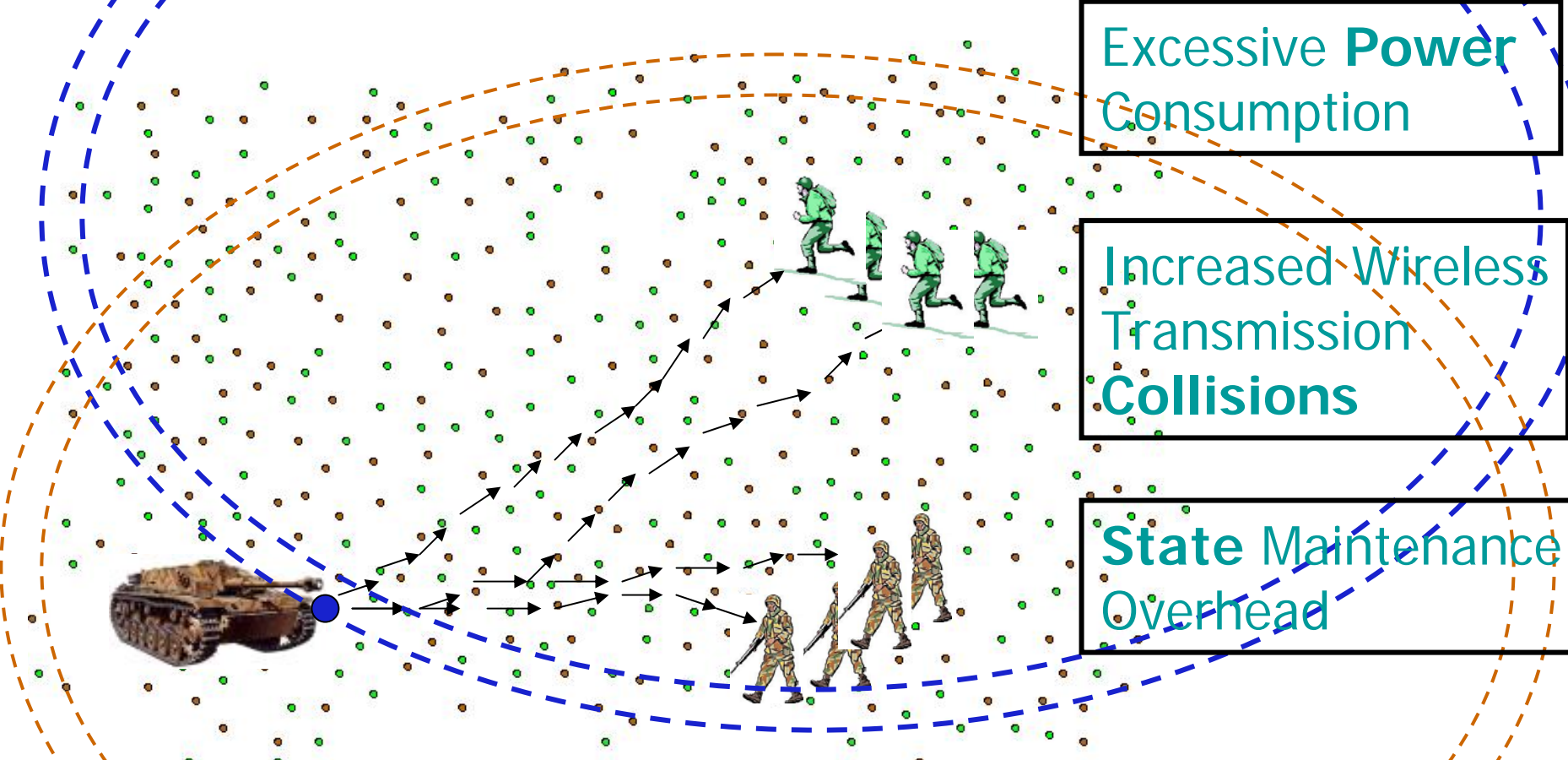
TTDD: A Two-tier Data Dissemination Model for Large-scale Wireless Sensor Networks

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Outline

- Data dissemination to mobile sinks
- Two-tier query and data forwarding
- Performance evaluation
- Related work
- Conclusion

Mobile Sink



Excessive **Power** Consumption

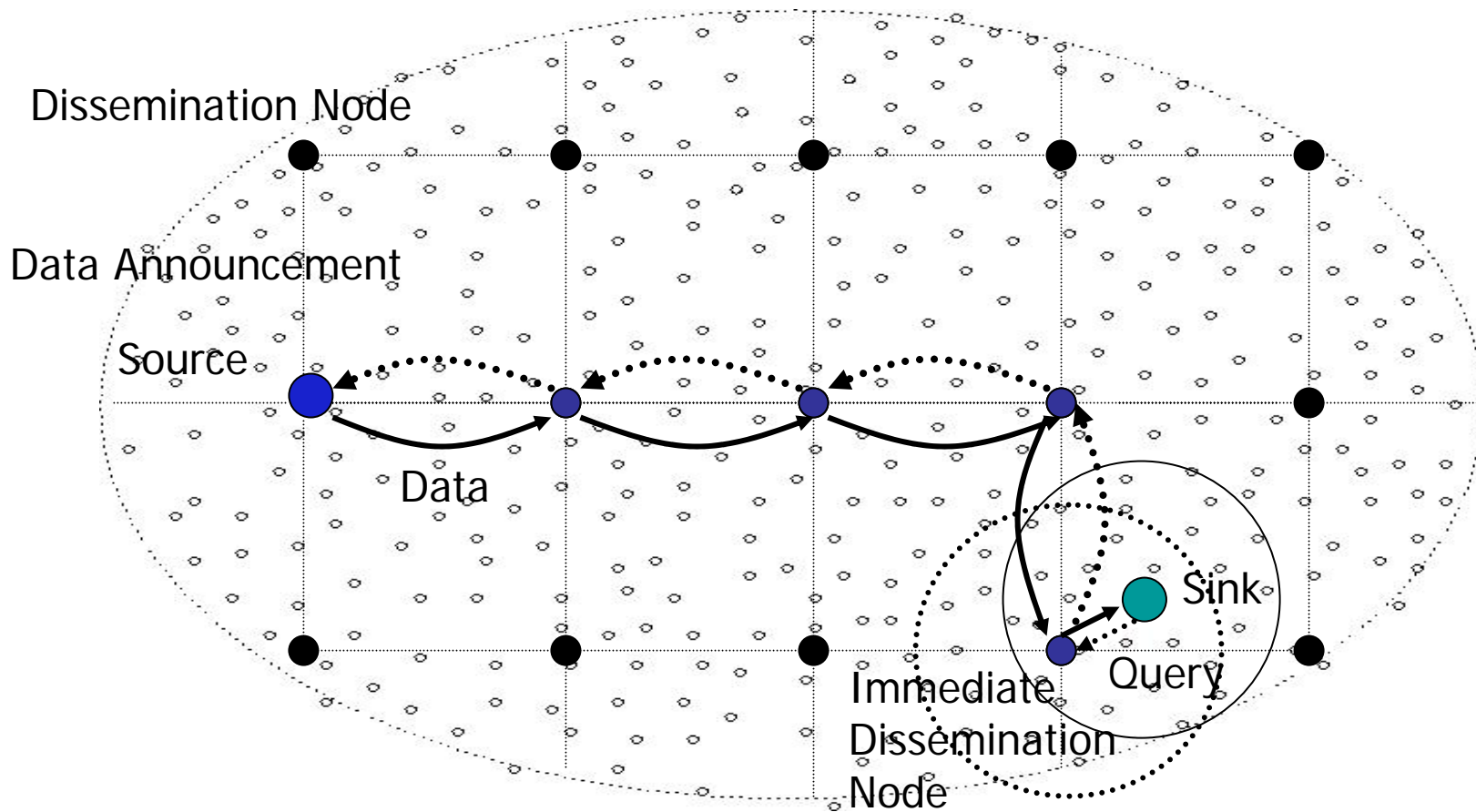
Increased Wireless Transmission **Collisions**

State Maintenance Overhead

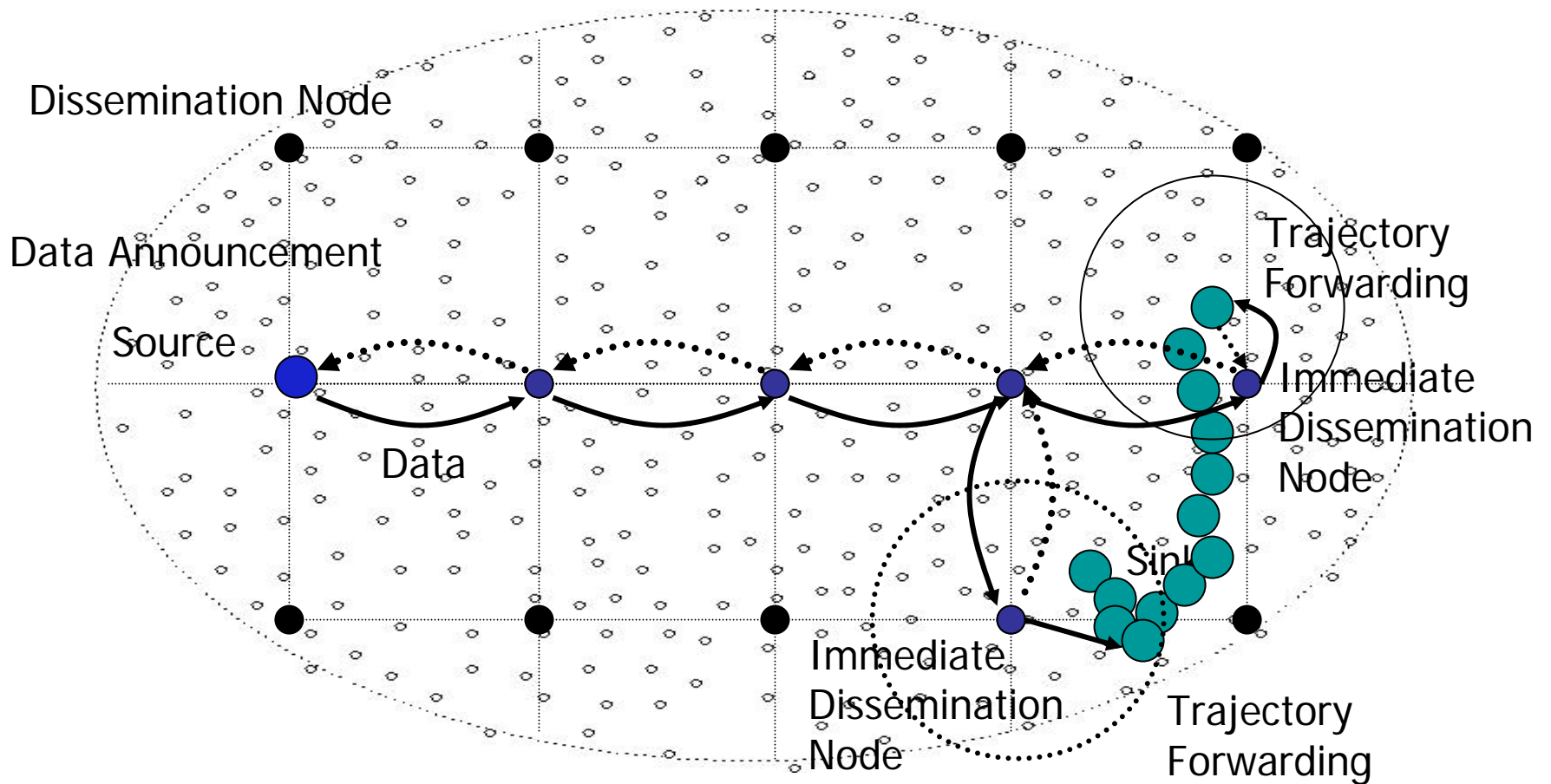
Goal, Idea

- Efficient and scalable data dissemination from multiple sources to multiple, mobile sinks
- Two-tier forwarding model
 - Source proactively builds a grid structure
 - Localize impact of sink mobility on data forwarding
 - A small set of sensor node maintains forwarding state

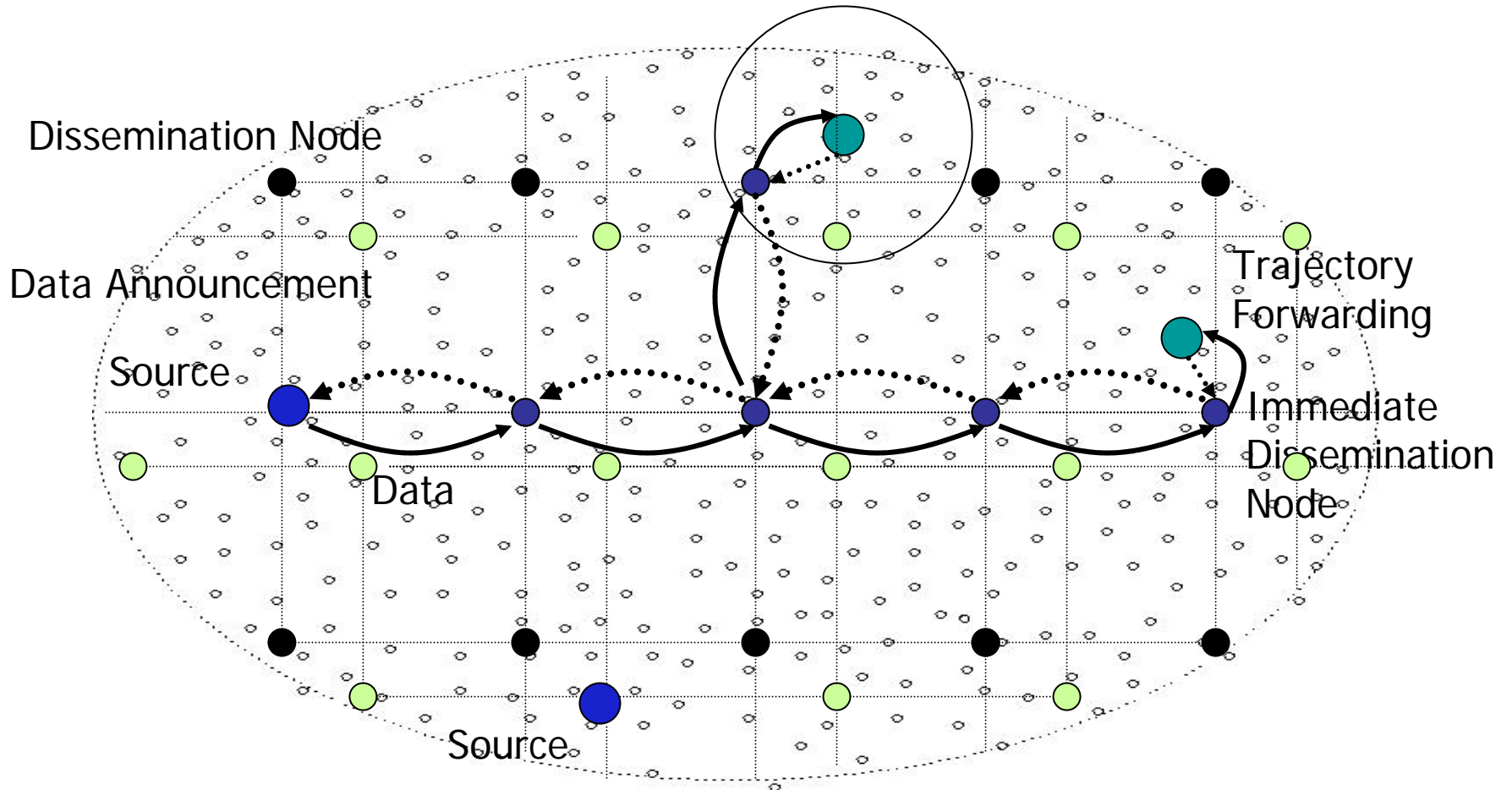
TTDD Basics



TTDD Mobile Sinks



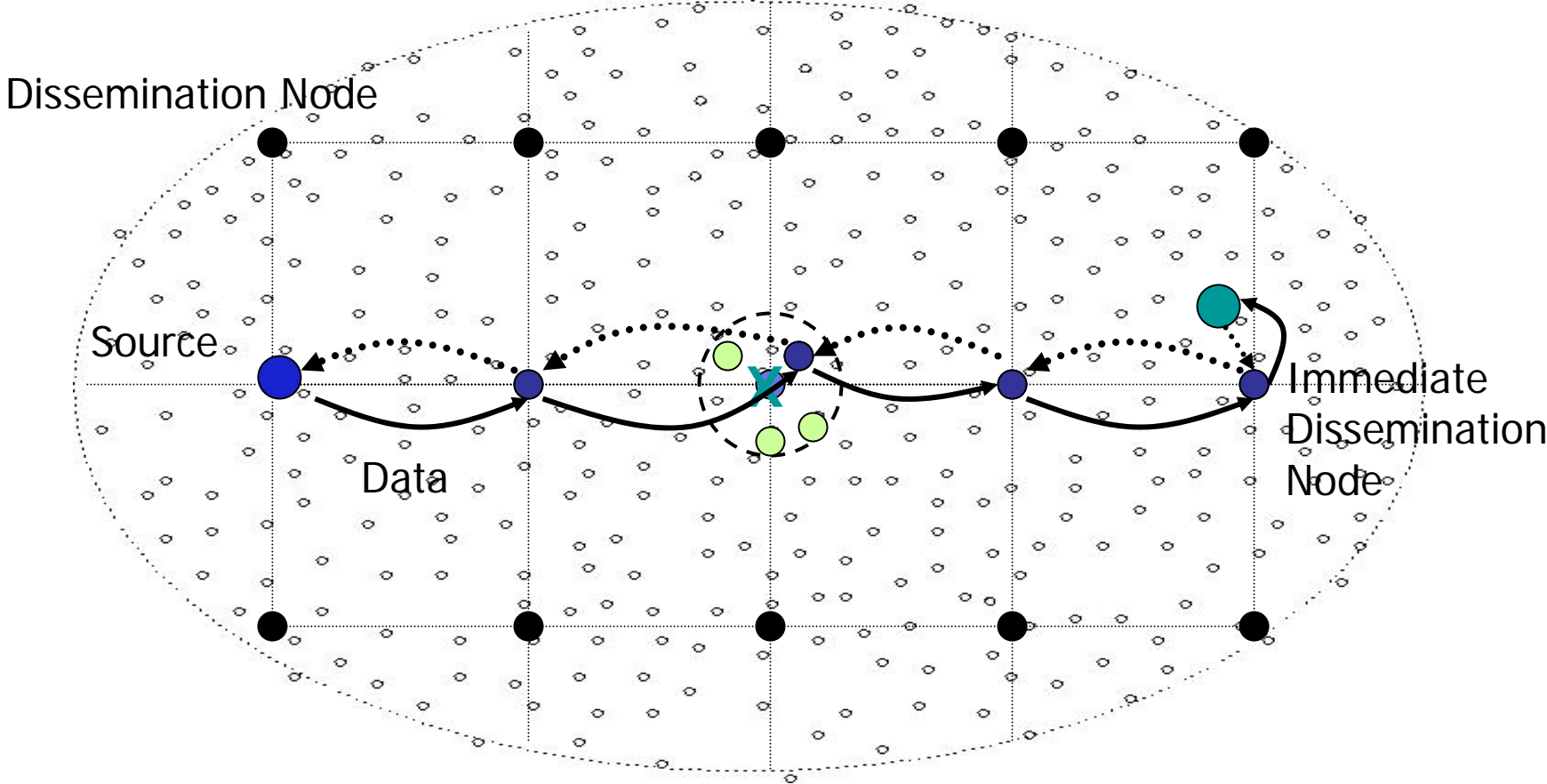
TTDD Multiple Mobile Sinks



Grid Maintenance

- Issues:
 - Handle unexpected dissemination node failures
 - Efficiency
- Solutions:
 - Source sets the Grid Lifetime in Data Announcement
 - **DN replication**: each DN recruits several sensor nodes from its one-hop neighbor, replicates the location of the upstream DN
 - DN failure detected and replaced **on-demand** by **on-going query and data flows**

Grid Maintenance



Performance Evaluation

- Compare with sink-oriented data dissemination (SODD) approaches
- N nodes, k sinks, m number of cells traversed, area of size A
- Number of nodes in each cell

$$n = \frac{N\alpha^2}{A}$$

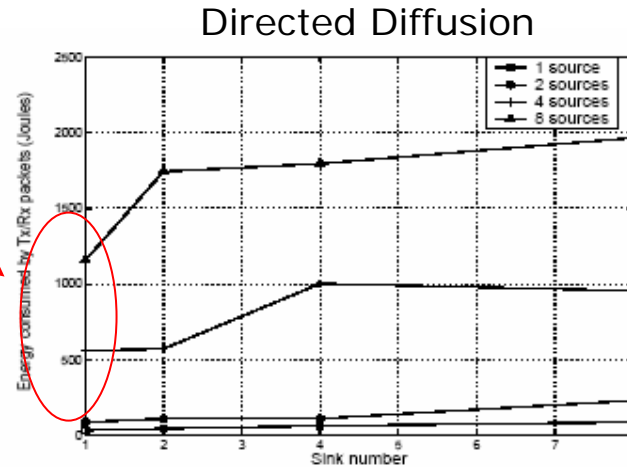
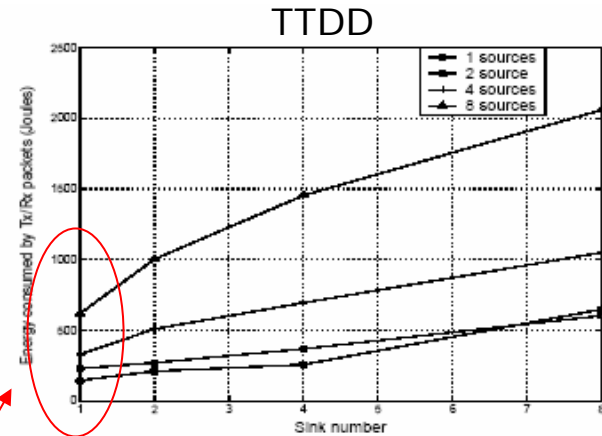
- Communication overhead

$$\frac{CO_{TTDD}}{CO_{SODD}} \rightarrow \frac{1}{mk} \left(1 + \frac{4}{\sqrt{n}} \right)$$

Ns-2 Simulation

- Metrics
 - Energy consumption, delay, success rate
- Impacts of
 - Cell size
 - Number of sources and sinks
 - Sink mobility
 - Node failure rates

When number of sinks is small TTDD consumes much less power



Conclusion

- TTDD: two-tier data dissemination Model
 - Exploit sensor nodes being stationary and location-aware
 - Construct & maintain a grid structure with low overhead
- Proactive sources
 - Localize sink mobility impact
- Infrastructure-approach in stationary sensor networks
 - Efficiency & effectiveness in supporting mobile sinks