

# Distributed Indexing and Data Dissemination in Large Scale Wireless Sensor Networks

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## Outline

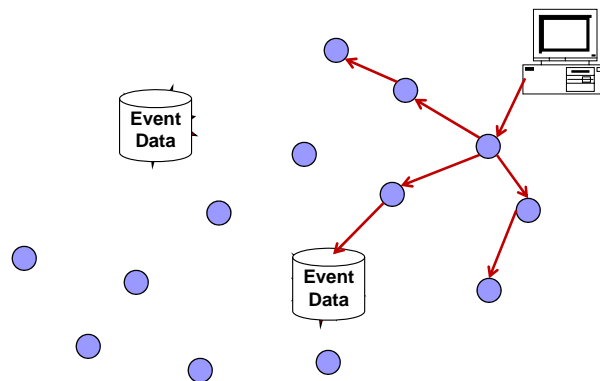
- Motivation
- Introduction
- Connected dominating set Based Index (CBI) scheme
- Simulation
- Conclusion and Future work

## Motivation

- Many data dissemination techniques proposed for wireless sensor networks may not work well in a large scale sensor network
  - where a huge amount of sensing data are generated.
- Design goals
  - providing timely responses to queries
  - Ensures scalability and load balance

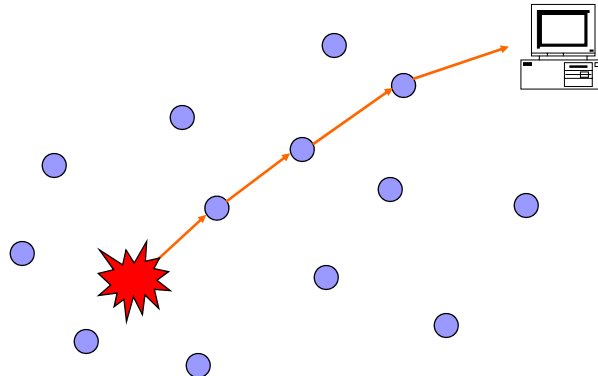
## Introduction

- Local Storage (LS)



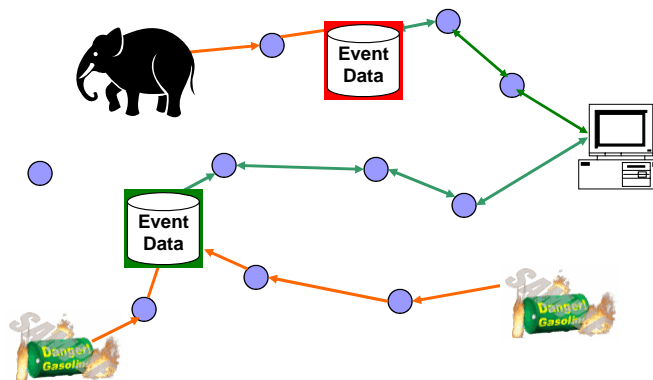
## Introduction

- External Storage (ES)



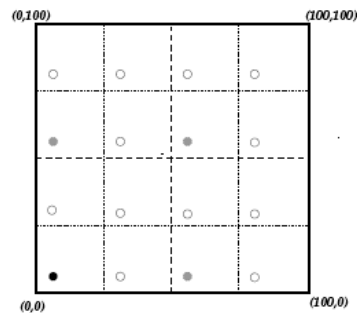
## Introduction

- Data-Centric Storage (DCS)



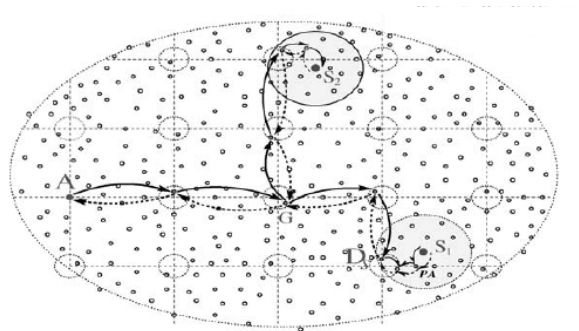
## Introduction

- Index
  - to provide low average query and storage communication
  - Quad-tree approach



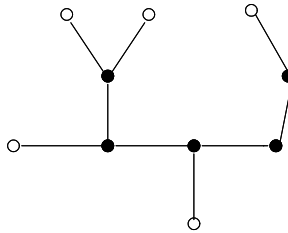
## Introduction

- Index
  - grid approach



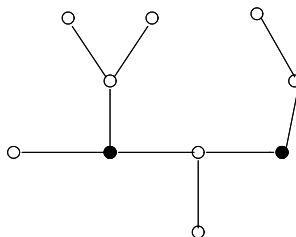
## CBI data dissemination scheme

- For a graph  $G(V,E)$ , a **Dominating Set**  $S$  of  $G$  is defined as a subset of  $V$  such that each node in  $V \setminus S$  is adjacent to at least one node in  $S$ .
- A **Connected Dominating Set (CDS)**  $C$  of  $G$  is a dominating set of  $G$  which induces a connected subgraph of  $G$ .



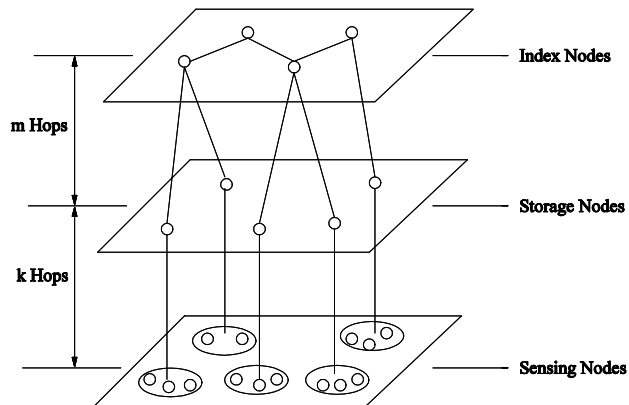
## CBI – Cont'd

- A  **$k$ -hop dominating set**  $D$  in  $G$  is a set of nodes with the property that every node in  $G$  is at most  $k$  hops away from at least one of the nodes of  $D$ .



## CBI – Cont'd

- Network hierarchy



## CBI – Cont'd

- Storage Nodes
  - K-hop dominating set of the whole network
  - Sensing data are collected and stored at the nodes close to the sensing nodes.
  - can combine data from different sources by using functions such as suppression (eliminating duplicates), Min, Max and Average

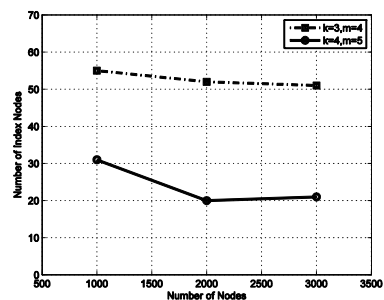
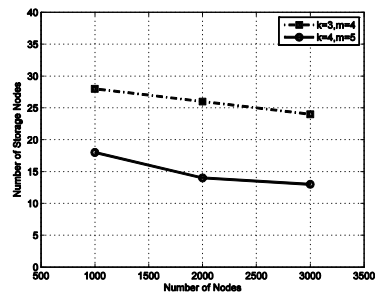


## Simulation

- Simulation Setting
  - $K=3$  and  $m=5$
  - 2000 nodes
  - 150X150 square
  - Transmission range is 10
  - Sensing range is 5
  - The size of data message  $S_d=80$
  - The size of query message  $S_q=10$
  - The size of an index update message  $S_i=10$
  - 10 mobile targets randomly move whose velocities are 0.25
  - Assume that the result of one target is returned for each query
  - Simulation duration time is 100

## Simulation

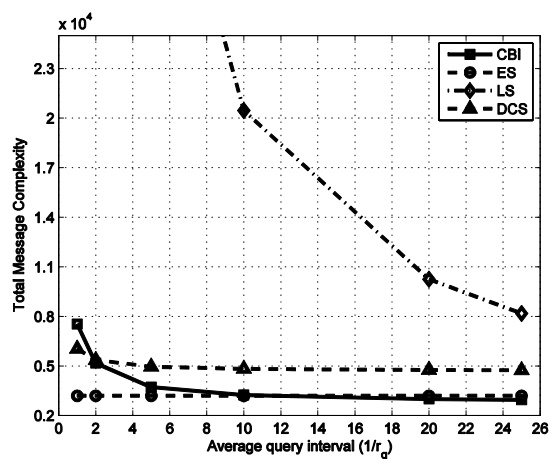
- *Comparison of the storage nodes and index nodes with different  $k$  and  $m$*



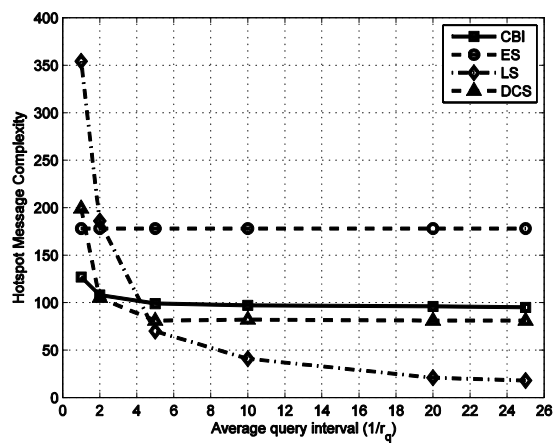
## Simulation

- *Comparing performances of different data dissemination schemes*
  - *total message complexity*
    - total number of messages generated in the whole network.
  - *hotspot message complexity*
    - the maximum number of messages sent by one single node
  - *total traffic complexity*
    - the amount of data sent by all nodes
  - *hotspot traffic complexity*
    - the maximum amount of data sent by each node.

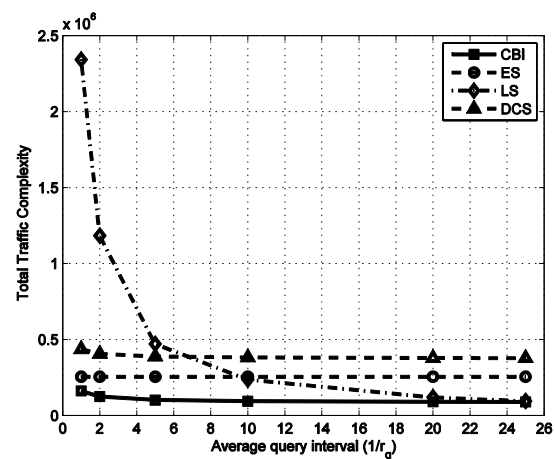
## Simulation



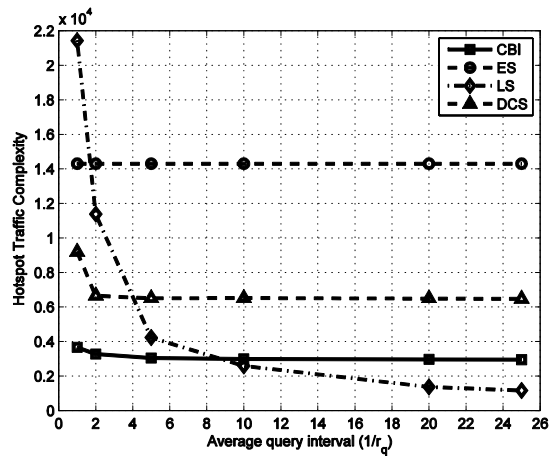
## Simulation



## Simulation



## Simulation



## Conclusion

- We proposed an integrated distributed Connected Dominating Based Indexing (CBI) data dissemination method to support scalable handling of large amount of sensing data in large scale wireless sensor networks.
  - CBI can provide timely responses to queries.
  - CBI data dissemination framework ensures scalability and load balancing.
- Simulation results show that the CBI scheme outperforms the ES, LS and the DCS schemes in overall performance.

## Future work

- Our future work is how to maintain our data dissemination framework in presence of network dynamic changes.

Q & A

Thanks