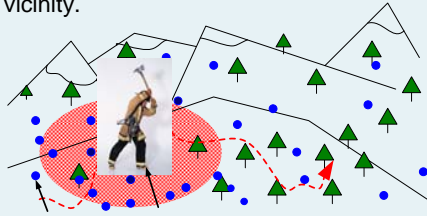


# Scalable Querying and Tracking of Sensor Networks from Mobile Platforms (preliminary version)

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## Scenarios

A firefighter moves through a mountainous forest and constantly monitors the information on the sensors in his vicinity.



Scenario with many query nodes: amusement park

## Goals

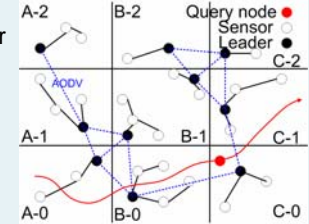
- Provide highly scalable mechanisms to query the sensor network from mobile platforms
- Track sensor data over time

## System Model

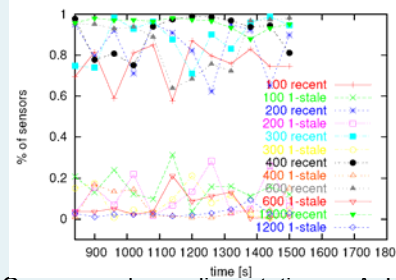
- Sensors are stationary, query nodes (qn) mobile
- Communication is wireless and ad-hoc
- Power constraints are not primary concerns

## SENSTRAC

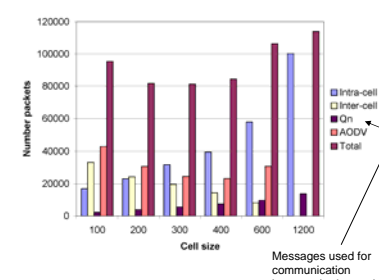
- Based on pub/sub: queries are mapped to topic subscriptions
- The underlying sensor network is structured into a grid overlay with cell leaders that act as brokers
- Intra-cell routing via shortest path to cell leader
- Inter-cell routing based on AODV
- Sensors send updates to cell leader
- Query nodes send subscriptions to closest broker
  - Subscriptions time out (lease-based model)



## Simulation – Cell Size

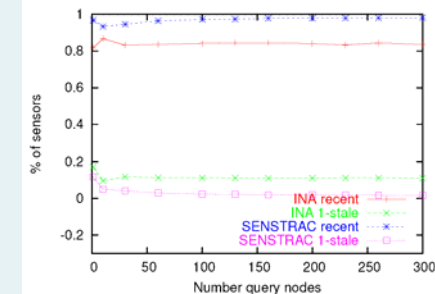
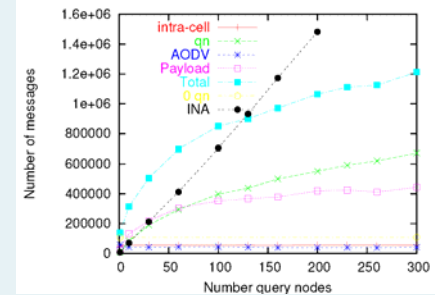


- Qn moves along a line, stationary AoI
- Larger cells generally result in higher sensor coverage, unless cell changes occurs
- Lowest message overhead for cell size 300m



## Scalability

- Mobility: random waypoint
- Comparison with in-network aggregation (INA) approach
  - Sub-linear message overhead increase



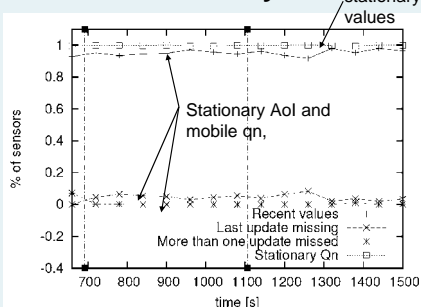
## Summary

- Our approach scales well with increasing number of query nodes
- It allows the query node to query any sensors (not necessarily only close-by sensors)

## Simulation

- Using Java-based Jist/Swans network simulator
- Simulating a network of 600 nodes, in a field 1200x1200m with max transmission range 88m
- Message losses due to hidden terminal problem
- Sensors send updates containing the current time every 50s, query nodes (default speed 1m/s) send new subscriptions every 60s. Area of Interest (AoI) is 400x400m.
- We measure the sensor coverage: sensors from which the query node received an update over all sensors in the AoI
  - recent: known sensor value is less than 60s old
  - 1-stale: known sensor value is between 60 and 120s old
  - n-stale: older than 1-stale

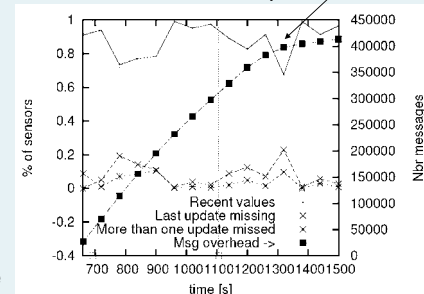
## Simulation - Mobility



- Stationary AoI
- Qn moves along a straight line
- Vertical lines show cell changes
- Some updates lost upon a cell change

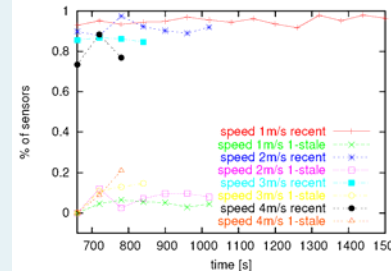
- AoI moves with the query node

- When query nodes stop subscribing
  - msg overhead flattens out
  - lease-based subscriptions



## Simulation – Qn Speed

- Sensor coverage decreases with increasing speed
- 1 qn moves along straight line, stationary AoI



## Simulation – AoI

- Increasing the size of the AoI decreases the sensor coverage (1 cell -> 4 cells -> all)
- The position of AoI does not impact the results (1 cell boundary -> x-ing 4 cell boundaries)

