Distributed Scheduling over Heterogeneous Wireless Sensor Networks

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Wireless Sensor Network

Data Acquisition Network
- 3d ultrasonic anemometer
- Animal Monitoring
- Solar radiation
- Ship Monitoring
- Precipitation
- Temperature, humidity
- Weather station

Data Distribution Network
- PDA
- Notebook
- Cellular Phone
- Mobile and Stationary Operations
- PC
- Storage

HPWREN

In-flight camera
Stationary camera
Seismic sensor

Operations
HPWREN Overview

- Wireless MESH
  - QoS scheduling and routing
  - Fast wireless connectivity
- Sensor Cluster Heads
  - Key issue:
    - Delivering good QoS
    - With long battery lifetime
  - Use faster radio to support QoS requirements
- Sensor Network
  - Battery lifetime
  - QoS
    - not considered in traditional sensor network research
Motivation

- Communication power, high traffic load
- Contention/collisions between child cluster heads
- Interference from neighboring cells

- Manage the number of contending nodes
  - Reduces packet collisions
  - Improves channel utilization
Node-level scheduling

- Manages the number of contending nodes
- Reduces collisions and achieves additional throughput improvement
Distributed node-level scheduling

- Uses the partial knowledge of topology
  - Two-hops distance of connectivity
- Scalable and flexible
Cell-level Scheduling

- Reduces interference from neighboring cells
- Does not schedule two neighboring cells in the same time slot

Three-slots cell-level scheduling

Two-slots cell-level scheduling
Combining cell-level / node-level scheduling

**Cell-level scheduling**

- $C_1$
- $C_2$

**Node-level scheduling**

- $n_1$
- $n_2$
- $n_3$
- $n_4$
- $n_5$
- $n_6$
- $n_7$
- $n_8$
Simulation Setup

- Power mode parameters
  - *Cisco Aironet 802.11b Wireless LAN adapter*
- Wireless channel model
  - 802.11b model: 11Mbps data rate, 1Mbps control rate
- Two types of multi-cell topology
  - Hexagonal / square topology
Results for CBR Traffic in Full MAC Queues

Communication power

Average throughput

Hexagonal multi-cell

Square multi-cell
Results for Real Traffic

Hexagonal multi-cell

Square multi-cell